# AL-FARABI KAZAKH NATIONAL UNIVERSITY

# INFORMATION
## about publication activity
## DEPARTMENT OF PHYSICS AND TECHNOLOGY

| № | Наименование публикации | Выходные данные *(doi статьи)* | Аннотация статьи | Ссылка для цитирования *(Ф.И.О., название статьи, название, номер и/или выпуск, том журнала, страницы, doi статьи)* |
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| | | | **2022 год** | |
| 1. | Gravitational field of slightly deformed naked singularities | 10.1140/epjc/s10052-022-10230-2 | We derive a particular approximate solution of Einstein equations, describing the gravitational field of a mass distribution that slightly deviates from spherical symmetry. The deviation is described by means of a quadrupole parameter that is responsible for the appearance of a curvature singularity, which is not covered by a horizon. We investigate the motion of test particles in the gravWe derive a particular approximate solution of Einstein equations, describing the gravitational field of a mass distribution that slightly deviates from spherical symmetry. The deviation is described by means of a quadrupole parameter that is responsible for the appearance of a curvature singularity, which is not covered by a horizon. We investigate the motion of test particles in the gravitational field of this naked singularity and show that the quadrupole parameter affects the properties of Schwarzschild trajectories. By investigating radial geodesics, we find that no effects of repulsive gravity are present. We interpreted this result as indicating that | Toktarbay, S., Quevedo, H., Abishev, M., Muratkhan, A., "Gravitational field of slightly deformed naked singularities", European Physical Journal C, 2022, 82(4), 382, Q2 10.1140/epjc/s10052-022-10230-2 |

| | | | repulsive gravity is non-linear effect.itational field of this naked singularity and show that the quadrupole parameter affects the properties of Schwarzschild trajectories. By investigating radial geodesics, we find that no effects of repulsive gravity are present. We interpreted this result as indicating that repulsive gravity is non-linear effect. | |
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| 2. | Reaction rate of radiative $p^{12}N$ capture | 10.1016/j.nuclphysa.2022.122543 | The S-factor of radiative $p^{12}N$ capture at energies from 20 keV to 5 MeV was considered within the modified potential cluster model with forbidden states, considering the first resonance at $E_x = 2.69(5)$ MeV. It was shown that one can obtain the astrophysical S-factor based on potentials consistent with the bound state energies and asymptotic constant values. According to the theoretical total cross sections, the calculation of the $p^{12}N$ capture reaction rate is made at temperatures from 0.001 to 10 $T_9$. The calculated results for the reaction rate are approximated by analytical expression, which simplifies their use in applied research | Dubovichenko, S.B., Burkova, N.A., Zazulin, D.M., "Reaction rate of radiative $p^{12}N$ capture", Nuclear Physics A, 2022, 1028, 122543, Q3, 10.1016/j.nuclphysa.2022.122543 |
| 3. | Reaction rate of radiative $n^6Li$ capture in the temperature range from 0.01 to 10 $T_9$ | 10.1016/j.nuclphysa.2022.122520 | We consider the rate of radiative $n^6Li$ capture reaction in the temperature range from 0.01 to 10 $T_9$ within the framework of the modified potential cluster model with forbidden states. The total cross sections are calculated for capture to the ground, and the first excited states of the $^7Li$ nucleus in the $n^6Li$ channel in the energy range from 10 meV to 5 MeV. Analytical expressions approximate the total cross-section at low energies and the reaction rate over the entire considered temperature range. | Dubovichenko, S.B., Burkova, N.A., Tkachenko, A.S., "Reaction rate of radiative $n^6Li$ capture in the temperature range from 0.01 to 10 $T_9$", **Nuclear Physics A**, **2022, 1027, 122520,Q3** 10.1016/j.nuclphysa.2022.122520 |
| 4. | Li 6 (p,γ) Be 7 reaction rate in the light of the new data of the Laboratory for Underground Nuclear Astrophysics | 10.1103/PhysRevC.105.065806 | We present new calculations of the astrophysical S factor and reaction rate for the Li6(p,γ)Be7 reaction at energies of 10 keV to 5 MeV in the framework of a modified potential cluster model with forbidden states, including low lying resonances. The astrophysical S(E) factor is compared with the available experimental data and calculations done within different models. The results for the S factor are in good agreement with the data set (for E<0.3 MeV) and calculations (for E<0.6 | Dubovichenko, S.B., Tkachenko, A.S., Kezerashvili, R.Y., Burkova, N.A., Dzhazairov-Kakhramanov, A.V., "Li 6 (p,γ) Be 7 reaction rate in the light of the new data of the Laboratory for Underground Nuclear Astrophysics", Physical Review C, 2022, 105(6), 065806, 10.1103/PhysRevC.105.065806 |

| | | | MeV) of the LUNA Collaboration [Phys. Rev. C 102, 052802(R) (2020)2469-998510.1103/PhysRevC.102.052802]. The recommended extrapolated zero value S(0) turned out to be 101 eV b. Using the theoretical total cross sections, the Li6(p,γ)Be7 capture reaction rate is calculated at temperatures ranging from 0.01T9 to 10T9 and compared with NACRE and NACRE II. Analytical expressions for the S factor and reaction rate are given, and the effect of low-lying resonances on the reaction rate is estimated. We suggest updating the NACRE and NACRE II databases in light of the new LUNA data and present calculations. | |
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| 5. | Reaction Rate of p $^6$Li Capture | 10.1007/s11182-022-02583-8 | The radiative p$^6$Li capture process has been treated within the framework of the modified potential cluster model with forbidden states at energies from 10 keV to 10 MeV with allowance for the first excitation energy resonance at excitation energies exceeding the p$^6$Li channel threshold by 7.2 or 1.6 MeV. The experimental data on the astrophysical S-factor are well reproduced based on the interaction potentials relevant to the bound state energies and the corresponding asymptotic coefficients. Based on the total cross sections calculated at energies from 1 keV to 5 MeV, the reaction rates of p$^6$Li radiative capture have been calculated at temperatures in the range from 0.01 to 10 $T_9$. The obtained reaction rates have been approximated by simple expressions easier to use in other works. | Dubovichenko, S.B., Burkova, N.A., Dzhazairov-Kakhramanov, A.V., Tkachenko, A.S., Samratova, A., "Reaction Rate of p $^6$Li Capture", **Russian Physics Journal**, **2022, 64(12), стр. 2237–2245, Q4,** 10.1007/s11182-022-02583-8 |
| 6. | Radiative p $^{11}$C Capture Reaction Rate | 10.1007/s11182-022-02515-6 | Within the frame of the modified potential cluster model with classification of orbital states according to Young's diagrams, the astrophysical S-factor of radiative p$^{11}$C capture was calculated. The calculations considered all scattering resonances up to 3.5 MeV and were performed at energies up to 5 MeV. On the basis of the obtained total cross sections, the reaction rate was calculated at temperatures from 0.01 to 10.0 $T_9$, and its simple parameterization was proposed | Dubovichenko, S.B., Burkova, N.A., Shamitova, R.R., Radiative p $^{11}$C Capture Reaction Rate, **Russian Physics Journal**, **2022, 64(9), стр. 1741–1748, Q4,** 10.1007/s11182-022-02515-6 |

| 7. | Rapidly rotating Dirac stars | 10.1103/PhysRevD.106.024021 | Within general relativity, we construct sequences of rapidly rotating Dirac stars consisting of a spinor fluid described by an effective equation of state. We find the physically relevant domain of stable configurations and calculate their principal characteristics which are completely determined by the central density of the spinor fluid, the mass of the nonlinear spinor field, and the velocity of rotation. It is demonstrated that for a certain choice of the spinor field mass, the main physical characteristics of the Dirac stars are close to those that are typical of rotating neutron stars. | Dzhunushaliev, V., Folomeev, V., Burtebayev, N.," Rapidly rotating Dirac stars", **Physical Review D**, **2022, 106(2), 024021, Q1,** 10.1103/PhysRevD.106.024021 |
| 8. | Proca balls with angular momentum or flux of electric field | 10.1103/PhysRevD.105.016022 | Within SU(2) Higgs-Proca theory, we obtain a family of nontopological static solutions describing localized, finite-energy configurations (Proca balls). The gauge symmetry of the theory is explicitly broken by introducing a vector Proca field whose components have different masses. Such solutions describe particlelike systems, the crucial feature of which is that they either possess a nonzero total angular momentum or have a flux of electric field through the plane of symmetry of such objects. It is shown that the angular momentum is provided by static crossed electric and magnetic fields. The existence of the solutions is caused by the fact that we circumvent the conditions of the no-go theorem, according to which there are no stationary and axially symmetric spinning excitations for the 't Hooft-Polyakov monopoles, Julia-Zee dyons, sphalerons, and also vortices. The dependence of some integral physical quantities on the ratio of the Proca-field masses is studied. It is demonstrated that the inclusion of external sources (charges) enables one to obtain solutions with equal Proca-field masses. We also discuss the possibilities of using quarks as sources of the Proca field under investigation and for treating the Proca balls as glueballs in SU(2) Higgs-Proca theory. | Dzhunushaliev, V., Folomeev, V., "Proca balls with angular momentum or flux of electric field", **Physical Review D**, **2022, 105(1), A32, Q1,** 10.1103/PhysRevD.105.016022 |

| 9. | Features of Scattering by a Nonspherical Potential | 10.1134/S106377962 2020447 | A model for solving the scattering problem by an axially symmetric potential has been developed. On the basis of this model, the interaction of the $^{238}$U isotope with a neutron has been studied. The correct accounting for the nonspherical shape of the uranium nucleus is accented. The optical potential has been used as the model. The spherically symmetric and nonspherical potentials are shown to result in different pictures of scattering, and, particularly, different resonance features of scattering. One of the directions of development of nuclear physics can be conditionally called extensive. Progress in the use of numerical methods leads to the necessity for the maximum possible account of all possible aspects of nuclear interactions, already known in principle. Relatively recently, the possibility of considering the nonspherical form of the nuclear interaction has been included in the software packages that allow calculating nuclear reactions, along with other necessary components [1, 2]. In the former work, the calculation of the interaction is based on the use of the TDHF approximation [3], in the latter, on the use of classical trajectories. On the one hand, the effect of nonsphericity is included in the code packages, while on the other hand, the calculation of the interaction is based on approximate, sometimes not even quantum-mechanical, schemes. In this study, we treat new effects arising from scattering by a nonspherical potential in the framework of quantum mechanics. As an example, one of the widely used reactions of nuclear power energetics was chosen—the interaction of a neutron with the nucleus of uranium-238. The interaction is described using an optical potential, which is one of the most popular simple potentials. | Krassovitskiy, P.M., Pen'kov, F.M., "Features of Scattering by a Nonspherical Potential", Physics of Particles and Nuclei, 2022, 53(2), стр. 247–250, Q4, 10.1134/S1063779622020447 |
| 10. | New Nuclear Physical Phenomenon: Spontaneous Nuclear Synthesis | 10.1134/S106377962 2020873 | For the first time, we describe a new nuclear-physical phenomenon: the emission of the lightest clusters with mass numbers from 1 to 4 from complex nuclei. The phenomenon is interpreted based on the statement that multiclusters recently experimentally discovered in the | Yushkov A.V., Itkis M.G., Dyachkov V.V., Zaripova Y.A, "New Nuclear Physical Phenomenon: Spontaneous Nuclear Synthesis", Physics of Particles and Nuclei, 2022, 53(2), |

| | | | volume of nuclei spontaneously enter with each other in thermonuclear fusion reactions, forming the mentioned lightest clusters with noticeable kinetic energies in the exit channels. | стр. 447–455, Q4, 10.1134/S1063779622020873 |
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| 11. | Phosphate Glass Detectors for Heavy Ion Identification | 10.3390/universe8090474 | The problem of the boundaries of the Mendeleev table of chemical elements is closely related to the understanding of the properties of nuclear matter. In this regard, the synthesis of superheavy nuclei on accelerators and the registration of their decay products are of fundamental scientific interest. The Joint Institute of Nuclear Research in Dubna (JINR) conducts research on the synthesis of superheavy nuclei on the new DC-280 cyclotron (the Factory of Superheavy Elements). As part of the development of this experiment, the possibility of using phosphate glass as a material for detectors of heavy and superheavy nuclei is being considered. This issue requires test experiments to study the recording properties of the glass at different irradiation and treatment conditions. The article presents a method for identifying heavy ions in phosphate glass detectors under various conditions by the geometric characteristics of ion tracks. The results obtained indicate the possibility of using the KNFS-3 phosphate glass detectors for registration and identification of accelerated superheavy nuclei. | Burtebayev Nassurllaa, Chernyavskiy Mikhailc, Gippius Alexeic; Kalinina Galinac; Konovalov Ninac; Nassurlla Marzhana, Nassurlla M.; Kvochkina Tatyanaa; Nassurlla Maulena; Okateva Nataliaa,; Pan Andreya; Polukhina Natalia,; Sadykov Zhakypbek "Phosphate Glass Detectors for Heavy Ion Identification ", Universe, 2022, 8(9), 474, 10.3390/universe8090474 |
| 12. | Charge-changing cross sections for Ca 42-51 and effect of charged-particle evaporation induced by neutron-removal reactions | 10.1103/PhysRevC.106.014617 | Charge-changing cross sections $\sigma_{CC}$ for Ca42-51 on a carbon target at around 280 MeV/nucleon have been measured. Though the existing point-proton radii $r_p$ of Ca isotopes increase as the neutron number increases, the measured $\sigma_{CC}$ data show a significant decrease, which is against the expectation from a simple Glauber-like model. We found that this observed phenomenon could be attributed to the charged-particle evaporation effect induced by the neutron-removal reaction. By taking the evaporation effect into account, various $\sigma_{CC}$ data sets for nuclides from C to Fe isotopes on C12 measured at around 280 MeV/nucleon are reproduced with a standard deviation of 1.6%. It is also clarified that this evaporation effect becomes negligibly small in the | Tanaka M., Takechi M.; Homma A.; Prochazka A.; Fukuda M.; Nishimura D.; Suzuki T.; Moriguchi T.; Ahn D.S.; Aimaganbetov A.; Amano M.; Arakawa H. "Charge-changing cross sections for Ca 42-51 and effect of charged-particle evaporation induced by neutron-removal reactions", Physical Review C, 2022, 106(1), 014617, Q2, 10.1103/PhysRevC.106.014617 |

| | | | neutron-rich region. The evaluated relation between σCC and rp using the current model indicates that σCC data for neutron-rich Ca isotopes (A≥51) are highly sensitive to rp. This high sensitivity potentially allows one to determine the rp of very neutron-rich nuclei. | |
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| 13. | Deuteron scattering and (d,t) reaction on $^{11}$B at an energy of 14.5 MeV | 10.1016/j.nuclphysa.2022.122448 | At an energy of 14.5 MeV, the elastic and inelastic scattering of deuterons and the (d, t) reaction on $^{11}$B nuclei were studied. Experimental angular distributions with transitions to the states of the $^{11}$B nucleus (ground state ($3/2^-$), 4.445 ($5/2^-$) MeV, 6.743 ($7/2^-$) MeV) and to the states of the $^{10}$B nucleus (ground state ($3^+$), 0.718 MeV ($1^+$), 1.74 MeV ($0^+$, T = 1), 2.15 MeV ($1^+$)) were analyzed by the coupled channel method. The value of the quadrupole deformation parameter $\beta_2$= 0.80 ± 0.2 was extracted. The assumption of a direct mechanism for picking up a neutron in the reaction (d, t) made it possible to describe rather well the measured angular distributions for the states of the $^{10}$B nucleus. The values of the spectroscopic amplitudes for the transitions to these states have been extracted. It is shown that the mechanism of $^8$Be transfer both in the form of a whole cluster and in the sequential transfer of two α-particles does not play a significant role. It was found that the deformation of the $^{10}$B and $^{11}$B nuclei noticeably affects the calculated cross sections for the (d, t) reaction. | Nassurlla Maulena, Burtebayev N, Sakuta S.B, Karakozov B.K, Burtebayeva J, Khojayev R, Sabidolda A, Yergaliuly G, "Deuteron scattering and (d,t) reaction on $^{11}$B at an energy of 14.5 MeV", Nuclear Physics A, 2022, 1023, 122448, Q3, 10.1016/j.nuclphysa.2022.122448 |
| 14. | Break-up effect of the weakly bound$^6$Li ions scattered by$^{208}$Pb target | 10.31349/REVMEXFIS.68.031201 | Using different potentials based on phenomenological, semi microscopic, and microscopic models, we investigated the reaction dynamics induced by the weakly bound $^6$Li ions on a heavy mass target $^{208}$Pb at sixteen energy sets ranging from 25 MeV to 210 MeV. The $^6$Li cluster nature and its dissociation into a core (α-particle) and a valence particle (deuteron) orbiting this core was taken into consideration using the cluster folding model (CFM). The new version of Sao Paulo potential (SPP2) is also used to | Hamada, S., Burtebayev, N., Ibraheem, A.A., "Break-up effect of the weakly bound$^6$Li ions scattered by$^{208}$Pb target", **Revista Mexicana de Fisica**, **2022, 68(3), 031201, Q3,** 10.31349/REVMEXFIS.68.031201 |

| | | | investigate $^6$Li+$^{208}$Pb data. In order to reproduce the experimental data, the strength of real part of potential created using SPP and CFM should be reduced by ~ 49 % and 62 %, respectively. The data could be well reproduced using non-renormalized real cluster folding potential, if an additional dynamical polarization potential (DPP) of repulsive real surface form is introduced. The observed reduction in the strength of the real double folded and cluster folding potentials is due to the break-up effect of $^6$Li. | |
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| 15. | Features of Registration of Accelerated Heavy Ions by Phosphate Glass Detectors at Different Temperatures | 10.1134/S106377612 2040033 | Abstract: The characteristics of heavy ion tracks in phosphate glasses after irradiation under various temperature conditions are presented. Calibration experiments are performed to obtain the dependence of the parameters of the etched tracks on the sample heating temperature and time and on the moment of heating a sample in relation to irradiation and etching. To effectively identify the ion charges, the stability of reproducing the optimum chemical etching conditions (etching chemical solution composition, concentration, etching time) is strictly observed in processing irradiated glasses. The results obtained allow us to conclude that phosphate glasses can be effectively used to detect and identify the superheavy nuclei synthesized at the Factory of Superheavy Elements of the Joint Institute for Nuclear Research (JINR). | Burtebaev N., Argynova K., Chernyavskiy M.M, Gippius A.A., Konovalova N.S, Kvochkina T.N., Nasurlla M, Okateva N.M, Pan A.N., Polukhina N.G, Sadykov, Zh. T, Shchedrina T.V., "Features of Registration of Accelerated Heavy Ions by Phosphate Glass Detectors at Different Temperatures", Journal of Experimental and Theoretical Physics, 2022, 134(4), стр. 528–532, Q4, 10.1134/S1063776122040033 |
| 16. | Search for possible fission modes at high excitation energies in Fm 254 | 10.1103/PhysRevC.1 05.044614 | Background: Shell effects have been found to influence both the compound nuclear fission (CNF) and quasifission processes. Besides quasifission processes, which fission modes remain active at excitation energy (E?) as high as 56 MeV should be investigated. Purpose: We investigate the signatures of fission modes in Fm254 populated by O16+U238 through the mass distribution (MD) and total kinetic energy distribution | Banerjee Tathagataa, Kozulin E.M., Burtebayev N.T, Gikal K.B, Knyazheva G.N., Itkis I.M., Novikov K.V, Kvochkina T.N, Mukhamejanov Y.S., Pan A.N, "Search for possible fission modes at high excitation energies in Fm 254", Physical |

| | | | (TKED). Method: The mass-Total kinetic energy distributions (M-TKED) of fission fragments of the reaction O16+U238 have been measured at two laboratory energies Elab=89 and 101 MeV. The spontaneous fission (SF) of Fm254, one-dimensional (1D) fragment MD, and two-dimensional (2D) M-TKEDs of O16+U238 have been described by the multimodal random neck rupture (MM-RNR) model. Results: Channel probabilities and the characteristics of different fission modes are obtained and discussed in detail. The enhancement observed in the mass yield (?10-2%) in the region 60-70 u for the light fragments at E-45 MeV goes away at the higher E-56 MeV. The heavy fragments of S1 and S2 modes are found to be associated with Z?53 and Z?56 shells, respectively. The slope of asymmetric to symmetric fission yields (when plotted against E?) of O16+U238 is found to be similar to that of previously reported O18+Pb208. Conclusions: Analysis of 2D M-TKED data by the MM-RNR model reveals the possible presence of fission modes in O16+U238. The liquid-drop-like broad symmetric SL mode is found to peak at a lower energy than predicted by the Viola systematic, which matches mostly with that of Standard 2 mode. No signature of asymmetric quasifission is observed. The MD widths show a linear dependence with the measured energies | Review C, 2022, 105(4), 044614, Q2, 10.1103/PhysRevC.105.044614 |
| 17. | Study of the $^{13}$C($^3$He, α)$^{12}$C reaction at energies of 50 and 60 MeV | 10.1088/1402-4896/ac5af6 | Cross sections for the 13C(3He, α)12C reaction were measured for 12C states up to excitation energies of about 20 MeV for 3He energies of 50 and 60 MeV. An analysis of the measured angular distributions was carried out using the Coupled Channels Born Approximation method under the assumption of a direct one-step mechanism of picking up a neutron from the 13C nucleus. In these calculations, the real parts of the implemented potentials were constructed within the framework of the double folding model. This analysis made it possible to extract the values of the spectroscopic factors for the 13C g.s. → 12C g.s. | Nassurlla Maulen, Burtebayev N, Karakozov B.K; Sakuta S.B.; Janseitov D; Nassurlla Marzhana, Alimov D; Burtebayeva J.; Sabidolda A.; Kemper K.W.; Khojayev R.; Hamada Sh, "Study of the $^{13}$C($^3$He, α)$^{12}$C reaction at energies of 50 and 60 MeV", Physica Scripta, 2022, 97(4), 045302, Q2, 10.1088/1402-4896/ac5af6 |

| | | | ($12C_*$) + n configurations, which were found to be in reasonable agreement with theoretical predictions. | |
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| 18. | Asymptotic normalization coefficient for $^{12}C$ + p→ $^{13}N$ from the $^{12}C$ ($^{10}B$ , $^9Be$) $^{13}N$ reaction and the $^{12}C$ (p, γ) $^{13}N$ astrophysical S factor | 10.1140/epja/s10050-021-00652-z | This work is aimed at clarifying the contribution of the proton direct radiative capture to the $^{12}C$ (p, γ) $^{13}N$ reaction by specifying the value of the asymptotic normalization coefficient (ANC) for $^{12}C$ + p→ $^{13}N_{g.s.}$. In order to do this, the differential cross section of the proton transfer in the 12C(10B,9Be)13N reaction at an energy of 41.3 MeV has been measured and analyzed through the modified distorted wave Born approximation (MDWBA) method taking into account the reaction channel coupling and $^3He$ cluster transfer contributions. The value of the ANC was derived to be $1.63\pm0.13$ fm$^{-1/2}$, which was used in estimating the astrophysical S(E) factor and the reaction rate of the proton radiative capture by the $^{12}C$ nucleus at energies of astrophysical relevance. | Artemov S.V., Yarmukhamedov R., Burtebayev N.b, Karakozov B.K., Ergashev F. Kh, Nassurlla Maulen, Igamov S.B., Amangeldi N.b, Morzabayev A.b, Burtebayeva J., Zhdanov V.S., Yergaliuly G., "Asymptotic normalization coefficient for $^{12}C$ + p→ $^{13}N$ from the $^{12}C$ ($^{10}B$ , $^9Be$) $^{13}N$ reaction and the $^{12}C$ (p, γ) $^{13}N$ astrophysical S factor", European Physical Journal A, 2022, 58(2), 24, Q2, 10.1140/epja/s10050-021-00652-z |
| 19. | Fluctuations of Initial State and Event-by-Event Pseudo-Rapidity Correlations in High Energy Nuclear Collisions | 10.3390/universe8020067 | The initial state, about which there is usually very little direct experimental information, leads to significant fluctuations in the distribution of secondary particles and fragments. In this paper, to estimate the initial state the fragmentation parameters of interacting nuclei are analyzed. To investigate the correlations, the Hurst method is used. A detailed study of event-by-event pseudo-rapidity correlations in terms of the Hurst index, multiplicity of secondary particles and target dependence has been carried out for heavy (AgBr) and light (HCNO) targets present in the nuclear emulsion (NIKFI BR-2) using Au-197 projectiles at 10.6 A GeV. Evidences of short-range particle correlations and cluster formation in the pseudo-rapidity space are found from our analy-sis. The total ensemble of events has been divided into four classes depending on the behavior of Hurst index: uncorrelated, with short-range correlations, with long-range correlations and mixed. Events of various types differ significantly in the multiplicity of secondary particles, fragmentation of the | Burtebayev, Nassurlla, Fedosimova, Anastasiya, Lebedev Igor, Dmitriyeva Elena, Ibraimova, Sayora, Bondar Ekaterina, "Fluctuations of Initial State and Event-by-Event Pseudo-Rapidity Correlations in High Energy Nuclear Collisions", Universe, 2022, 8(2), 67, Q2, 10.3390/universe8020067 |

| | | | projectile nucleus, and have significant differences in the pseudo-rapidity distribution of secondary particles. | |
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| 20. | Single-particle and cluster modes of 1 3 C excited states of 3.09, 8.86 and 9.89 Mev | 10.1142/S021830132 2500318 | The elastic and inelastic scatterings of deuterons from 13C are registered in a wide range of angles at the laboratory energy of 14.5MeV. Data on the differential cross-sections are treated within both the optical model and coupled-channels method. A new set of optical potential parameters is found. Analyses of the d +13C nuclear reactions are carried out for the levels of excitation 3.089, 8.86 and 9.87MeV. The single particle 12C+n, and cluster 9Be+α models are applied in calculations of differential cross-sections. The calculations show that the state 3.089MeV is populated with the single particle configuration, while the latter bands 8.86MeV and 9.87MeV mainly have the cluster 9Be+α excitation. The major contribution of the Hoyle state of the core 12C is not observed, but the cluster 9Be+α configuration is ascertained to be the main contributor to the state 8.86MeV | Urazbekov B.A.;Starastcin V.A. Karakozov B.K.; Burtebayev N.T; Janseitov D.M. Nasrulla M; Alimov D.; Valiolda D.S.; Kazhykenov S.H.; Denikin A.S.; Demyanova A.S.; Danilov A.N "Single-particle and cluster modes of 1 3 C excited states of 3.09, 8.86 and 9.89 Mev", International Journal of Modern Physics E, 2022, 2250031, Q4, 10.1142/S0218301322500318 |
| 21. | Accretion Disk Luminosity for Black Holes Surrounded by Dark Matter with Tangential Pressure | 10.3847/1538-4357/ac8804 | We study the motion of test particles in the gravitational field of a Schwarzschild black hole surrounded by a spherical dark matter cloud with nonzero tangential pressure, and compute the luminosity of the accretion disk. The presence of nonvanishing tangential pressure allows us to mimic the dark matter's angular momentum, while still considering a static model, which simplifies the mathematical framework. We compare the numerical results of the influence of dark matter on the luminosity of the accretion disks around static supermassive black holes with the previously studied cases of isotropic and anisotropic pressures. We show that the flux and luminosity of the accretion disk in the presence of dark matter are different from the case of a Schwarzschild black hole in a vacuum, and highlight the impact of the presence of tangential pressures | Boshkayev K., Konysbayev T.; Kurmanov, Ye, Luongo O.; Malafarina D , "Accretion Disk Luminosity for Black Holes Surrounded by Dark Matter with Tangential Pressure", Astrophysical Journal, 2022, 936(2), 96, Q1, 10.3847/1538-4357/ac8804 |
| 22. | Accretion Disk Luminosity for Black Holes Surrounded | | We investigate the luminosity of the accretion disk of a static black hole surrounded by dark matter with anisotropic pressure. We calculate all basic orbital parameters of test particles in the accretion disk, such | Kurmanov, E., Boshkayev, K., Giambò, R., Konysbayev T. Luongo O., Malafarina, D., Quevedo, H., |

| | | | as angular velocity, angular momentum, energy, and radius of the innermost circular stable orbit as functions of the dark matter density, radial pressure, and anisotropic parameter, which establishes the relationship between the radial and tangential pressures. We show that the presence of dark matter with anisotropic pressure makes a noticeable difference in the geometry around a Schwarzschild black hole, affecting the radiative flux, differential luminosity, and spectral luminosity of the accretion disk. | "Accretion Disk Luminosity for Black Holes Surrounded by Dark Matter with Anisotropic Pressure", Astrophysical Journal, 2022, 925(2), 210, Q1, 10.3847/1538-4357/ac41d4 |
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| by Dark Matter with Anisotropic Pressure | 10.3847/1538-4357/ac41d4 | | | |
| 23. | Pedagogical Model for Raising Students' Readiness for the Transition to University 4.0 | 10.3390/su14158970 | The study goal was to analyze the impact of using modern technologies and pedagogical innovations based on the University 4.0 model on the educational process effectiveness, the development of professional competencies (in humanities and engineering) and skills in students (abstract-logical thinking, critical thinking, strategic thinking, imagination, creativity, motivation), and learners' readiness and motivation to shift to University 4.0. The experiment was conducted in the Al-Farabi Kazakh National University among 464 undergraduate students of different academic years. All the study respondents were distributed into two groups, one of which did not change the training program (control group), and the other studied under the program grounded on the University 4.0 model using modern technologies (experimental group). According to the results of the survey addressed to the students of both groups after the experiment ended, the indicators for all parameters were higher among the individuals of the experimental group. The practical significance of the results obtained and further research prospects are in the possibility of using the developed training program in different universities and departments worldwide to compare both students' readiness for the transition to University 4.0 and the program's impact on educational outcomes. | Jugembayeva,B., Murzagaliyeva, A., Revalde, G., " Pedagogical Model for Raising Students' Readiness for the Transition to University 4.0", Sustainability (Switzerland), 2022, 14(15), 8970, Q2, 10.3390/su14158970 |
| 24. | Natural sorbents and scientific description of their use | 10.32014/2022.2518-170X.159 | Oil pollution, both in terms of scale and toxicity, is a general planetary danger. Oil and petroleum products cause poisoning, death of organisms and soil | Almatova, B., Khamzina, B., Murzagaliyeva, A., Abdygalieva, A., Kalzhanova, A., "Natural sorbents |

| | | | degradation. Natural self-purification of natural objects from oil pollution is a long process, especially in conditions where a low temperature regime persists for a long time. The solution of the cleaning problem the soil cover from oil pollution, the development of new and improvement of existing technologies for the restoration of oil-contaminated lands is among the priorities. Diatomites are organic sedimentary rocks, the basis of which are the remains and fragments of unicellular diatomite algae. Many of their deposits are widely represented in the Republic of Kazakhstan, the Russian Federation, China, the USA, Canada and other countries. In the methods of acid, alkaline and salt treatment, the process is aimed at weakening the microstructure of the sorbent, increasing porosity and specific surface layer. At the same time, chemical treatment contributes to a change in the features of the crystal structure, an increase in ion-exchange properties in accordance with the change in the composition of variable cations and the appearance of new active centers. Development of an invention for cleaning oil sludge and smeared soil without using a large volume of scarce fertilizer, replacing it with other plant organic residues, reduce the consumption of materials for cleaning, reduce the cost and accelerate it. | and scientific description of their use", News of the National Academy of Sciences of the Republic of Kazakhstan, Series of Geology and Technical Sciences, 2022, 2(452), стр. 49–57, Q4, 10.32014/2022.2518-170X.159 |
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| 25. | Formation of energy spectra of electrons in a dense weakly ionized plasma generated by fission fragments | 10.1002/ctpp.2021001 74 | For a weakly ionized dense plasma irradiated by fission fragments, the coupled self-consistent Boltzmann equations for fission fragments and electrons are defined. The evolution of the energy spectra of fast particles in a plasma is investigated on the basis of these equations. Studies of the energy distribution function of fission fragments and primary electrons for a helium-3 plasma irradiated by neutron flux, as well as their non-stationary and stationary analytical solutions, are found and analysed. | Shapiyeva, A., Son, E., Kunakov, S., "Formation of energy spectra of electrons in a dense weakly ionized plasma generated by fission fragments", Contributions to Plasma Physics, 2022, 62(4), e202100174, Q3, 10.1002/ctpp.202100174 |
| 26. | TITAN neutron imaging facility performance | 10.1016/j.nima.2022. 167078 | This paper presents the results of experiments on the TITAN facility to assess the quality of neutron imaging. A set of references samples developed by the Paul Scherrer Institute with the support of the IAEA was | Dyussambayev, D.S., Aitkulov, M.T., Shaimerdenov, A.A., Mukhametuly B, Nazarov K , Dikov  A.S., Kaestner A, Barradas N. Pessoa, Sairanbayev |

| | | | used. The results obtained demonstrated that the spatial resolution of the facility is 239μm for radiography and 358μm for tomography. The linear attenuation coefficients were determined for six materials. The maximum difference between the experimental values and the theoretical ones was 38%. The difference between the linear attenuation coefficients of neutron radiation from theoretical values is associated with the spectral dependence, due mainly to scattering and beam hardening that leads to deviation of the linear attenuation coefficient from the Beer–Lambert law. Tomography images were demonstrated that individual copper balls larger than 0.8 mm in diameter can be clearly recognized in a vial filled with balls. | D.S., Dikov A.S, Bazarbayev, E.M., "TITAN neutron imaging facility performance", Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors and Associated Equipment, 2022, 1039, 167078, 10.1016/j.nima.2022.167078 |
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| 27. | Study of the spatiotemporal structure of extensive air showers at high energies | 10.1088/1748-0221/17/04/C04014 | In a series of works carried out at the Tien-Shan High Altitude Science Station (TSHASS), a penetrating component of extensive air showers (EAS) caused by cosmic rays (CR) with energy of the primary particle above 1 PeV was discovered. The local increase in the energy of secondary hadrons in the EAS cores in the region of the CR spectrum slope change around energy of 3 PeV, the so-called "knee". The problem of knee formation currently is one of the currently still open mysteries in astrophysics. The studies carried out at the TSHASS show that more information on the knee region can be obtained by studying the characteristics of the EAS cores. At present, a large installation with an area of several hundred square meters is being constructed at the station to study the EAS cores in the "knee"region. The installation is located at an altitude of 3330 meters above sea level near the city of Almaty, Kazakhstan. | Kalikulov, O.A., Saduyev, N.O., Shaulov S.B., Zhukov V.V., Beznosko D., Mukhamejanov Y.S., Yerezhep N.O., Baktoraz A.Y., Shinbulatov S.K., Utey, Sh., Zhumabayev A.I., Sedov, A.N., Oskomov V.V., "Study of the spatiotemporal structure of extensive air showers at high energies", Journal of Instrumentation, 2022, 17(4), C04014, Q4, 10.1088/1748-0221/17/04/C04014 |
| 28. | Analysis of continuum level density for virtual and resonance states | 10.1007/s12648-020-01994-y | We investigate the effects of resonant or virtual state and non-resonant contributions in continuum level density. In addition, we discuss the decomposed continuum level density and the M1 transition strength in the scattering problem in terms of the Green function with complex scaling method. | Odsuren, M., Khuukhenkhuu, G., Sarsembayeva, A.T., Amangeldi, N., Katō, K., "Analysis of continuum level density for virtual and resonance states", Indian Journal of Physics, 2022, 96(2), стр. 543–547, Q3, 10.1007/s12648-020-01994-y |

| 29. | Investigation of low-lying resonances in breakup of halo nuclei within the time-dependent approach | 10.1140/epja/s10050-022-00684-z | We investigate the Coulomb breakup of $^{11}$Be halo nuclei on a heavy target ($^{208}$Pb) from intermediate (70 MeV/nucleon) to low energies (5 MeV/nucleon) within the non-perturbative semiclassical and quantum-quasiclassical time-dependent approaches. The convergence of the computational scheme is demonstrated in this energy range including n + $^{10}$Be low-lying resonances in different partial and spin states. We have found a considerable contribution of the $5/2^+$ resonance ($E_r$ = 1.23 MeV) to the breakup cross section at 30 MeV/nucleon and lower, while at higher energies, the resonant states $3/2^-$ and $3/2^+$ (with $E_r$ = 2.78 and 3.3 MeV) make most visible contributions. The obtained results are in good agreement with experimental data available at 69 and 72 MeV/nucleon. Comparison with the existing theoretical calculations of other authors for 20 and 30 MeV/nucleon is also made. The developed computational scheme opens new possibilities in the investigation of the Coulomb, as well as nuclear, breakup of other halo nuclei on heavy and light targets. | Valiolda D., Janseitov D., Melezhik V., "Investigation of low-lying resonances in breakup of halo nuclei within the time-dependent approach", European Physical Journal A, 2022, 58(2), 34, Q2, 10.1140/epja/s10050-022-00684-z |
| 30. | Investigation of fragmentation reactions of exotic nuclei in a high-energy approximation | 10.32523/ejpfm.2022060202 | Studies of the properties of nuclei remote from the "valley of nuclear stability" make it possible to predict the properties of new nuclides based on systematic accumulations of data on the structure of nuclear matter. New phenomena in the behavior of nuclear matter are also being discovered. Such cores are called "exotic". The production of exotic nuclei is a multi-stage process, during which various approaches of theoretical and experimental physics are applied. One of the ways to obtain nuclei are fragmentation reactions of relatively light nuclei with high energy (more than 100 MeV), as a result of which exotic nuclei with different A and Z can be obtained. In this article, a study of the applicability of the high-energy approximation (HEA) in modeling such direct nuclear reactions was conducted and the results of comparing this approach with the exact solution of | Ismailova, A.N., Janseitov, D.M., Sharov, P.G., "Investigation of fragmentation reactions of exotic nuclei in a high-energy approximation, "Eurasian Journal of Physics and Functional Materials, 2022, 6(2), стр. 109–117, 10.32523/ejpfm.2022060202 |

| | | | the Schrodinger equation using the example of a rectangular potential barrier and a Gaussian potential barrier are presented. Comparison of different approaches provides an understanding of the limitations of their applicability for further study of the properties of nuclei in interaction with each other and for solving the Schrodinger equation with similar potentials considered | |
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| 31. | Experimental study of fast fission and quasifission in the Ca 40 + Pb 208 reaction leading to the formation of the transfermium nucleus No 248 | 10.1103/PhysRevC.105.024617 | The stability of the transfermium nucleus against fission is mainly determined by the shell correction depending on its angular momentum and excitation energy. Purpose: The study of the fast fission process of the transfermium nucleus No248 and its dependence on the interaction energy and introduced angular momentum. Methods: Mass-energy distributions of the No248 fission fragments formed in the Ca40 + Pb208 reaction at energies above the Coulomb barrier have been measured using the double-arm time-of-flight spectrometer CORSET at the Ca40-beam energies of 223, 250, and 284 MeV. Results: The contribution of the fast fission process is determined from the calculations of the driving potential, taking into account shell effects and rotational energy and amounts to 39% and 61% at 250 and 284 MeV, respectively. The mass-energy distributions of the quasifission and fast fission fragments have been extracted by subtracting the mass-energy matrices associated with compound nucleus fission from those of all measured fissionlike events. The asymmetric fragments with masses 97 and 151 u were found to be the most probable in the fast fission of No248. With increasing Ca40 energy from 250 to 284 MeV the mass distributions of the fast fission fragments change slightly. Conclusions: Contrary to quasifission in which the fragments are focused mainly around the closed neutron or proton shells, the influence of known proton or neutron shells on the asymmetric mass distribution in the fast fission process was not observed. | Kozulin E.M, Knyazheva G.N., Bogachev A.A., Saiko V.V, Karpov A.V., Itkis I.M., Novikov K.V., Mukhamejanov Y.S., Pchelintsev I.V., Vorobiev I.V., Banerjee T, Cheralu , "Experimental study of fast fission and quasifission in the Ca 40 + Pb 208 reaction leading to the formation of the transfermium nucleus No 248", Physical Review C, 2022, 105(2), 024617, Q2, 10.1103/PhysRevC.105.024617 |
| 32. | Fission of | 10.1103/PhysRevC.105.014607 | The nature of asymmetric fission of preactinides is not yet understood in detail, despite intense experimental | Kozulin E.M; Knyazheva G.N.; Itkis I.M; Itkis M.G., Mukhamejanov Y.S.; |

| | | | and theoretical studies carried out at present. Purpose: The study of asymmetric and symmetric fission of Hg180,182,183 and Pt178 nuclei as a function of their excitation energy and isospin. Methods: Mass-energy distributions of fission fragments of Hg180, Pt178 (two protons less than Hg180), and Hg182 (two neutrons more than Hg180) formed in the Ar36+Sm144, Nd142, and Ca40+Nd142 reactions were measured at energies near and above the Coulomb barrier. Fission of Hg183 obtained in the reaction of Ca40 with Nd143 was also investigated to see if one extra neutron could lead to dramatic changes in the fission process due to the shape-staggering effect in radii, known in Hg183. The measurements were performed with the double-arm time-of-flight spectrometer CORSET. Results: The observed peculiarities in the fission fragment mass-energy distributions for all studied nuclei may be explained by the presence of a symmetric fission mode and three asymmetric fission modes, manifested by the different total kinetic energies and fragment mass splits. The yield of symmetric mode grows with increasing excitation energy of compound nucleus. Conclusions: The investigated properties of asymmetric fission of Hg180,182,183 and Pt178 nuclei point out the existence of well-deformed proton shell at Z≈36 and a less deformed proton shell at Z ≈ 46. | Bogachev A.A.; Novikov K.V.; Kirakosyan V.V.; Kumar D; Banerjee T; Cheralu M; Maiti M, "Fission of", Physical Review C, 2022, 105(1), 014607, Q2, 10.1103/PhysRevC.105.014607 |
| 33. | GRB 190829A—A Showcase of Binary Late Evolution | 10.3847/1538-4357/ac7da3 | GRB 190829A is the fourth-closest gamma-ray burst to date (z = 0.0785). Owing to its wide range of radio, optical, X-ray, and very-high-energy observations by HESS, it has become an essential new source that has been examined by various models with complementary approaches. Here, we show in GRB 190829A that the double prompt pulses and the three multiwavelength afterglows are consistent with the type II binary-driven hypernova model. The progenitor is a binary composed of a carbon-oxygen (CO) star and a neutron star (NS) companion. The gravitational collapse of the iron core of the CO star produces a supernova (SN) explosion and leaves behind a new NS (vNS) at its center. The | Wang, Yu; Rueda J.A.; Ruffini R.; Moradi R.; Li, Liang; Aimuratov Y.; Rastegarnia F.; Eslamzadeh S.; Sahakyan N.; Zheng, Yunlong , "GRB 190829A—A Showcase of Binary Late Evolution", Astrophysical Journal, 2022, 936(2), 190, Q1, 10.3847/1538-4357/ac7da3 |

| | | | accretion of the SN ejecta onto the NS companion and onto the vNS via matter fallback spins up the NSs and produces the double-peak prompt emission. The synchrotron emission from the expanding SN ejecta, with energy injection from the rapidly spinning vNS and its subsequent spindown, leads to the afterglow in the radio, optical, and X-ray bands. We model the sequence of physical and related radiation processes in BdHNe, and focus on individuating the binary properties that play the relevant roles | |
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| 34. | Development of a System for Detecting Traveling Ionospheric Disturbances Based on GNSS Data | 10.3390/atmos13020 183 | The large amount of data that are available for ionospheric studies using the GPS TEC method, as well as the need to take into account complex atmospheric dynamics, create certain difficulties in automating the process of searching and recognizing traveling ionospheric disturbances generated by different sources. To automate the process of detecting wave disturbances, numerical criteria for assessing the level of the wave disturbance signal were proposed. The signal-to-noise ratio calculated by the proposed method was used as one of such criteria. This work contains a description of the developed software system that implements the proposed methodology and allows the loading of RINEX files and processing, analyzing, and visualizing total electron content data. | Andreyev, A., Kapytin, V., Mukasheva, S., Somsikov, V., "Development of a System for Detecting Traveling Ionospheric Disturbances Based on GNSS Data", Atmosphere, 2022, 13(2), 183, Q3, 10.3390/atmos13020183 |
| 35. | Facile Low-Cost Synthesis of Highly Photocatalitycally Active Zinc Oxide Powders | DOI 10.3389/fmats.2022.8 69493 | The industrial waste can cause significant harm to human health and to the environment. Organic dyes in particular are environmentally dangerous since they may cause the death of aquatic life or contaminate the feed chain. Thus, one of the current research fields consists of the development of an inexpensive and environmentally friendly method to purify wastewater from organic contaminants. Among the others, Zinc oxide (ZnO) is considered one of the most effective photocatalysts for the decomposition of organic pollutants in water. In this work, we developed a highly efficient low-temperature | Kedruk, Y.Y., Baigarinova, G.A., Gritsenko, L.V., Cicero, G., Abdullin, K.A. / Frontiers in Materials, 2022 / DOI 10.3389/fmats.2022.869493 / ISSN 22968016 / Том 931 March 2022 Номер статьи 869493 / https://www.scopus.com/record/display.uri?eid=2-s2.0- |

| | | | and environmentally safe synthesis method to obtain photocatalytically active nanostructured ZnO by chemical precipitation from a solution. The effect of the technological conditions of synthesis on the photocatalytic properties is considered in detail, the correlation with the morphology, structural, and optical properties of the synthesized ZnO samples is determined. It was found that the maximum photocatalytic activity with respect to the decomposition of the dye rhodamine-B (RhB) is achieved for samples synthesized at NaOH molar concentration from 0.4 to 0.7 M; in this case, the sizes of crystallites along the crystallographic direction 002 reach maximum values of ~42 nm. On the contrary, the sizes of crystallites along the directions 100 and 101 decrease monotonically from 30 to 25 nm with an increase in the molar concentration of NaOH from 0.14 to 1 M. Copyright | 85128485422&origin=resultslist&sort=plf-f |
| 36. | Toward Understanding the B[e] Phenomenon. VIII. Nature and Variability of IRAS 07080+0605 | DOI 10.3847/1538-4357/ac6de0 | We report the results of spectroscopic and photometric observations of the emission-line object IRAS 07080+0605 carried out in 2004-2021. We found that the object is significantly underluminous for its spectroscopic properties (T eff = 8500 ± 500 K, log g = 2.0 ± 0.5), if a strong visual attenuation by a factor of ~43 found through the spectral energy distribution modeling is not taken into account. Visual brightness variations with a stable period of 190 days but a variable amplitude of ~0.2 mag were found in the ASAS SN data and attributed to variable circumstellar extinction in the dusty disk. We also found that the observed behavior of IRAS 07080+0605 is similar to that of the protoplanetary nebula Red Rectangle. The dusty disk of IRAS 07080+0605 shows the presence of carbonaceous | Khokhlov, S.A., Miroshnichenko, A.S., Zharikov, S.V.,Reva, I.V., Agishev, A.T. / Astrophysical Journal, 2022 / ISSN 0004637X /DOI 10.3847/1538-4357/ac6de0 / Том 932, Выпуск 11 June 2022 Номер статьи 36 / https://www.scopus.com/record/display.uri?eid=2-s2.0-85132986803&origin=resultslist&sort=plf-f |

| | | | particles (~10%-20% of the total dust content) and polycyclic aromatic hydrocarbon emission bands. However, IRAS 07080+0605 shows no obvious signs of the refractory element depletion, which is common in post-asymptotic giant branch (AGB) dusty binaries, or of a visual nebula. Absorption-line positions vary with an amplitude of ~25 km s-1, suggesting the presence of a secondary component. Spectroscopic monitoring on a timescale from days to months is needed to search for regular variations. We conclude that IRAS 07080+0605 is most likely a binary system with an A-type component on its way toward the post-AGB evolutionary stage, as binarity is capable of explaining most of the observed features. | |
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| 37. | Centre including eccentricity algorithm for complex networks | DOI 10.1049/ell2.12424 | In this work, the authors propose a new centre including eccentricity algorithm, to define the fractal dimension of networks. The authors did the fractal analysis of the real Escherichia coli network and a model UV-flower network and confirmed that these networks are fractals. The fractal dimensions ((Formula presented.)) of these networks are calculated and (Formula presented.) = 2.485 for the real E. coli network and (Formula presented.) = 2.1 for the UV-flower network is obtained. Also, the authors defined the fractal dimensions of real social networks and compared their method with Song's, Zhang's and Zheng's methods. Furthermore, the authors' algorithm can solve situations with single-node boxes at the edges of the network and can cover networks with minimum number of boxes. The authors believe that centre including eccentricity algorithm is competitive among existing algorithms and can be used to evaluate fractal properties of complex networks. | Akhtanov, S., Turlykozhayeva, D., Ussipov, N., Ibraimov, M., Zhanabaev, Z. / Electronics Letters, 2022 / ISSN 00135194 / DOI 10.1049/ell2.12424 / Том 58, Выпуск 7, Страницы 283 - 285March 2022 / https://www.scopus.com/record/display.uri?eid=2-s2.0-85122865977&origin=resultslist&sort=plf-f |

| 38. | Development of the High School Wave Optics Test | DOI 10.36681/tused.2022.1123 | In this paper, we described the development of the High School Wave Optics Test (HSWOT). Firstly, 56 conceptual, multiple-choice items with a single correct answer and three distractors were created. Next, we conducted an initial review of the items which resulted in reducing the item pool to 44 highest quality items. Validity evidence and feedback on the quality of these 44 items were collected through an expert survey and small-scale item try-out which included 3 subject-matter experts and 13 high school students, respectively. This process helped us to reduce our item pool to 30 technically improved conceptual items, which were eventually administered to 164 high-school students, from Kazakhstan. Finally, a Rasch analysis of the students' answers resulted in a 24-item scale for measuring conceptual understanding in high-school students. The item reliability proved to be good, person reliability was acceptable, and the difficulty of items was approximately person-independent. All distractors were chosen by at least 5% of students and 8 distracters were chosen by more than 35% of students. We could conclude that HSWOT may be effectively used for measuring conceptual understanding in advanced high-school physics courses and for identifying students' misconceptions in wave optics, in general | Balta, N., Japashov, N., Glamočić, D.S., Mešić, V. / Journal of Turkish Science Education, 2022 / ISSN 13046020 / DOI 10.36681/tused.2022.1123 / Том 19, Выпуск 1, Страницы 302 – 327-2022 / https://www.scopus.com/record/display.uri?eid=2-s2.0-85129364972&origin=resultslist&sort=plf-f |
| 39. | STEM Career Interest of Kazakhstani Middle and High School Students | DOI 10.3390/educsci12060397 | The aim of this study is to analyze secondary school students' career interests in STEM subjects. This survey-based quantitative research is provided to gain insight into the STEM career interests of 398 students (7–11 graders), in the Almaty region of the Kazakhstan Republic. Through parametric and non-parametric test analysis, the relationship between students' STEM | Japashov, N., Naushabekov, Z., Ongarbayev, S., Postiglione, A., Balta, N. / Education Sciences, 2022 / ISSN 22277102 / DOI |

| | | | career interest and their gender, their parents' occupation, parents' education, family size, school type, and school location were revealed. Results indicated that, on average, participant students showed positive interest in STEM careers. In particular, boys' and girls' responses were equally positive in many sub-scales of STEM. Additionally, great interest in STEM careers was shown by village students, whereas, for private school students who are living in the city, STEM career interests were the lowest in our sample. We also found that students' family size, parents' education, and occupation does not relate to students' STEM career interest. Implications for STEM education in Kazakhstan are further discussed in this study. | 10.3390/educsci12060397 / Том 12, Выпуск 6-June 2022 Номер статьи 397 / https://www.scopus.com/record/display.uri?eid=2-s2.0-85132273308&origin=resultslist&sort=plf-f |
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| 40. | Surface-Enhanced Raman Scattering from Dye Molecules in Silicon Nanowire Structures Decorated by Gold Nanoparticles | DOI 10.3390/ijms23052590 | Silicon nanowires (SiNWs) prepared by metal-assisted chemical etching of crystalline silicon wafers followed by deposition of plasmonic gold (Au) nanoparticles (NPs) were explored as templates for surface-enhanced Raman scattering (SERS) from probe molecules of Methylene blue and Rhodamine B. The filling factor by pores (porosity) of SiNW arrays was found to control the SERS efficiency, and the maximal enhancement was observed for the samples with porosity of 55%, which corresponded to dense arrays of SiNWs. The obtained results are discussed in terms of the electromagnetic enhancement of SERS related to the localized surface plasmon resonances in Au-NPs on SiNW's surfaces accompanied with light scattering in the SiNW arrays. The observed SERS effect combined with the high stability of Au-NPs, scalability, and relatively simple preparation method are promising for the application of | Ikramova, S.B., Utegulov, Z.N., Dikhanbayev, K.K., Savinov, V.P., Timoshenko, V.Y. / International Journal of Molecular Sciences, 2022 / ISSN 16616596 / DOI 10.3390/ijms23052590 / Том 23, Выпуск 5March-1 2022 Номер статьи 2590 / https://www.scopus.com/record/display.uri?eid=2-s2.0-85125403954&origin=resultslist&sort=plf-f |

| | | | SiNW:Au-NP hybrid nanostructures as templates in molecular sensorics. | |
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| 41. | Dual-band optical imaging system-integrated patch antenna based on anisotropic fractal for earth-observation CubeSats | DOI 10.1016/j.asej.2021.07.010 | This paper presents a dual-band optical imaging system-integrated patch antenna based on an anisotropic fractal for Earth-observation CubeSats. The antenna operates at S-band frequencies. The size of the antenna is chosen to match the end face of the CubeSats. The antenna's main characteristics are studied using simulation in Computer Simulation Technology (CST) software; prototypes are developed to verify these characteristics. Double-sided Glass Epoxy Sheet FR-4 is used to develop the antenna prototype. By studying the antenna prototype, realized gain up to 4 dBi and 2.15 dBi at two resonant frequencies of the antennas with different substrate heights are obtained. Small size, low cost, dual-band, and integration with the imaging system allow achieving the entire CubeSat system's efficiency. | Meirambekuly, N., Temirbayev, A.A., Zhanabaev, Z.Z., Khaniyev, B.A., Khaniyeva, A.K. / Ain Shams Engineering Journal, 2022 / ISSN 20904479 / DOI 10.1016/j.asej.2021.07.010 / Том 13, Выпуск 2 March 2022 Номер статьи 101560 / https://www.scopus.com/record/display.uri?eid=2-s2.0-85113809625&origin=resultslist&sort=plf-f |
| 42. | Development and design of an FPGA-based encoder for NPN | DOI 10.1080/23311916.2021.2008847 | This paper describes a cryptographic protection system hardware device designed to improve data encryption and decryption performance and preserve data integrity. The cryptosystem is implemented by hardware-software method, where the encryption and decryption of data are carried out in a stand-alone FPGA device based on non-positional polynomial number system (NPN). For data encryption the next block of text to be encrypted is divided into sub-blocks and represented as separate binary polynomials and binary polynomials-keys are assigned to them, as well as irreducible polynomials (modules). Then, split blocks are calculated in parallel and a ciphertext is formed. For this purpose, the special algorithm where calculation of NPN parameters and check on irreducibility of polynomials (modules) and the | Ibraimov, M.K., Tynymbayev, S.T., Skabylov, A.A., Kozhagulov, Y., Zhexebay, D.M. / Cogent Engineering, 2022 / ISSN 23311916 / DOI 10.1080/23311916.2021.2008847 / Том 9, Выпуск 12022 Номер статьи 2008847 / https://www.scopus.com/record/display.uri?eid=2-s2.0-85121568922&origin=resultslist&sort=plf-f |

| | | | program of generation of direct and inverse keys are developed and application functional is developed that implements operations in the ring of polynomials with coefficients GF(2) using an object-oriented approach. We have developed polynomial multipliers modulo sequential and parallel action (matrix multiplier) on the basis of which data encryption and decryption are performed. | |
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| 43. | Change of Optical Properties of Carbon-Doped Silicon Nanostructures under the Influence of a Pulsed Electron Beam | DOI 10.1155/2022/1320164 | In the work, porous silicon with observed photoluminescence was made from a p-type silicon substrate doped with boron and crystallographic orientation (100) using the method of electrochemical etching in a solution containing H2(SiF6) (silicon hydrofluoric acid) and ethyl alcohol. Thin carbon films were sprayed by high-frequency magnetron sputtering at room temperature onto the surface of porous silicon. The resulting carbon-doped thin films of porous silicon were irradiated on a pulsed electron booster and comparisons were made with nonirradiated films of porous silicon. To understand the effect of carbon on the properties of porous silicon films samples were analyzed by Raman spectroscopy, spectrophotometry, and scanning probe microscopy (SPM). The results of the SPM showed that the roughness of the samples increases after carbon doping on the surface of porous silicon. Thus, for the first time, experimental results were obtained on the effect of irradiation on carbon-doped porous silicon obtained in a solution containing hydrogen hexafluorosilicate H2(SiF6) and a significant change in its optical properties was shown. The results of the study showed that irradiated samples of carbon-doped | Darmenkulova, M.B., Aitzhanov, M.B., Zhumatova, S.A., Ibraimov, M.K., Sagidolda, Y. / Journal of Nanotechnology, 2022 / ISSN 16879503 / DOI 10.1155/2022/1320164 / Том 20222022 Номер статьи 1320164 / https://www.scopus.com/record/display.uri?eid=2-s2.0-85132015460&origin=resultslist&sort=plf-f |

| | | | porous silicon have better photoluminescence compared to nonirradiated samples. | |
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| 44. | DEVELOPMENT OF PIPELINED POLYNOMIAL MULTIPLIER MODULO IRREDUCIBLE POLYNOMIALS FOR CRYPTOSYSTEMS | DOI 10.15587/1729-4061.2022.251913 | In this paper, we consider a schematic solution of the pipeline multiplier modulo, where multiplication begins with the analysis of the lowest order of the polynomial multiplier, which can serve as an operating unit for high-speed encryption and decryption of data by hardware implementation of cryptosystems based on a non-positional polynomial notation. The functional diagram of the pipeline and the structure of its logical blocks, as well as an example of performing the operation of multiplying polynomials modulo, are given. The correct functioning of the developed circuit was checked by modeling in the Vivado Design Suite computer-aided design for the implementation of the multiplication device on the development/ evaluation kit Artix-7 based on the Spartan 6 field-programmable gate array series by Xilinx. The effectiveness of the proposed hardware pipeline multiplier in modulo is confirmed by the Verilog Testbench timing diagram implemented for the evaluation kit Artix-7 field-programmable gate array. In addition, the developed pipelined modulo multiplier takes no more than 0.02 % of the resources of the used field-programmable gate array for a given length of input data. Compared to the matrix multiplication method, a pipelined modulo multiplier can handle a large data stream without waiting for the result of the previous multiplication step. The modulo pipelined multiplier depth depends on the bit width of the input data. The developed pipeline device can be used in digital computing devices operating in a polynomial system of residue classes, as well as for | Tynymbayev, S., Ibraimov, M., Namazbayev, T., Gnatyuk, S. / Eastern-European Journal of Enterprise Technologies, 2022 / ISSN 17293774 / DOI 10.15587/1729-4061.2022.251913 / Том 1, Выпуск 4-115, Страницы 37 – 43-2022 / https://www.scopus.com/record/display.uri?eid=2-s2.0-85125722068&origin=resultslist&sort=plf-f |

| | | | high-speed data encryption in blocks of cipher processors operating on the basis of a non-positional polynomial number system | |
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| 45. | Designing of multi-objective optimal virtual power plant model for reliability enhancement in radial network: a case study of Indian power sector | DOI 10.1038/s41598-022-16389-8 | One of the major driving factors in the shifting of the present grid paradigm to an active grid network is the reliability and resiliency of the utility network. With hefty investment in the distribution network protection and maintenance, the reliability of the feeders is considerably enhanced; however, large numbers of outages are still occurring every year which caused major production loss to the manufacturing sector. In this paper, the role of the solar grid-based Virtual Power Plant (VPP) is evaluated in the state power utility for the reliability enhancement and cost minimization using a multi-objective model based on MILP optimization. A 90 bus industrial feeder having automatic reclosers, DER, and DSM is selected on which the MCS method is utilized for computing reliability indices using the utility reliability parameters. The value of reliability indices such as EENS is declined by 68% by utilizing the VPP scenario. These values of this reliability index are fed into the multi-objective model for cost minimization. After running the optimization, the results reveal that the operational and the annual energy cost are reduced by 61% and 55% respectively which advocates the VPP implementation in the utility network. Both modes of the Virtual Power Plant such as grid-connected and autonomous mode have been discussed in detail. Lastly, the results of the developed model with MILP are compared with the proprietary derivative algorithm, and it is found that the proposed MILP is more cost-effective. The overall results advocate the VPP | Sharma, H., Imanbayeva, A. / Scientific Reports, 2022 / ISSN 20452322 / DOI 10.1038/s41598-022-16389-8 / Том 12, Выпуск 1December 2022 Номер статьи 13382 / https://www.scopus.com/record/display.uri?eid=2-s2.0-85135427331&origin=resultslist&sort=plf-f |

| | | | implementation in the utility grid as the economical advantage is provided to both utility and the consumers in terms of reduction in EENS and energy charges respectively. | |
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| 46. | Features of determining the optical bandgap of amorphous nanosized composite TiO2:Ag films | DOI 10.1364/JOT.89.000052 | The study results of optical properties of amorphous nanosized TiO2:Ag composite films with the structure of an amorphous TiO2 matrix with inclusions of isolated Ag nanoparticles are presented. The TiO2:Ag films were obtained by ion-plasma high-frequency magnetron co-sputtering of a polycrystalline TiO2 and Ag target. The films were 40-50 nm thick, and the maximum silver concentration reached 9.0 at.%. The fundamental absorption band edge was analyzed for different possible absorption laws. It is shown that, in TiO2 and TiO2:Ag films, the edge of the fundamental absorption band is formed mainly due to indirect allowed optical transitions (the quadratic absorption law), and this absorption law does not change with increasing silver concentration. The optical bandgap in TiO2:Ag films depends on the Ag concentration and is determined by the degree of order in the amorphous matrix. | Peshaya, S.L., Prikhodko, O.Yu., Mukhametkarimov, Ye.S., Turmanova, K.N., Kudryashov, V.V. / Journal of Optical Technology (A Translation of Opticheskii Zhurnal), 2022 / ISSN 10709762 / DOI 10.1364/JOT.89.000052 / Том 89, Выпуск 1, Страницы 52 - 57January 2022 / https://www.scopus.com/record/display.uri?eid=2-s2.0-85127606246&origin=resultslist&sort=plf-f |

| 47. | Accretion Disk Luminosity for Black Holes Surrounded by Dark Matter with Tangential Pressure | DOI 10.3847/1538-4357/ac8804 | We study the motion of test particles in the gravitational field of a Schwarzschild black hole surrounded by a spherical dark matter cloud with nonzero tangential pressure, and compute the luminosity of the accretion disk. The presence of nonvanishing tangential pressure allows us to mimic the dark matter's angular momentum, while still considering a static model, which simplifies the mathematical framework. We compare the numerical results of the influence of dark matter on the luminosity of the accretion disks around static supermassive black holes with the previously studied cases of isotropic and anisotropic pressures. We show that the flux and luminosity of the accretion disk in the presence of dark matter are different from the case of a Schwarzschild black hole in a vacuum, and highlight the impact of the presence of tangential pressures. | Boshkayev, K., Konysbayev, T., Kurmanov, Y., Luongo, O., Malafarina, D. / Astrophysical Journal, 2022 / ISSN 0004637X / DOI 10.3847/1538-4357/ac8804 / Том 936, Выпуск 21 September 2022 Номер статьи 96 / https://www.scopus.com/record/display.uri?eid=2-s2.0-85137764656&origin=resultslist&sort=plf-f |
| 48. | Accretion Disk Luminosity for Black Holes Surrounded by Dark Matter with Anisotropic Pressure | DOI 10.3847/1538-4357/ac41d4 | We investigate the luminosity of the accretion disk of a static black hole surrounded by dark matter with anisotropic pressure. We calculate all basic orbital parameters of test particles in the accretion disk, such as angular velocity, angular momentum, energy, and radius of the innermost circular stable orbit as functions of the dark matter density, radial pressure, and anisotropic parameter, which establishes the relationship between the radial and tangential pressures. We show that the presence of dark matter with anisotropic pressure makes a noticeable difference in the geometry around a Schwarzschild black hole, affecting the radiative flux, differential luminosity, and spectral luminosity of the accretion disk. | Kurmanov, E., Boshkayev, K., Giambò, R., Malafarina, D., Quevedo, H. / Astrophysical Journal, 2022 / ISSN 0004637X / DOI 10.3847/1538-4357/ac41d4 / Том 925, Выпуск 21 February 2022 Номер статьи 210 / https://www.scopus.com/record/display.uri?eid=2-s2.0-85125834460&origin=resultslist&sort=plf-f |

| 49. | Localized surface plasmon resonance phenomenon in Ag/Au-WO3-x nanocomposite thin films | DOI 10.1016/j.tsf.2022.139387 | The localized surface plasmon resonance was investigated in composite thin films based on amorphous sub-stoichiometric tungsten oxide ($WO_{3-x}$) matrix and noble metal nanoparticles, such as silver (Ag), gold (Au), and their alloy (Ag/Au). The films were prepared by radio-frequency magnetron sputtering of a combined target consisting of lemon-colored tungsten trioxide powder and Ag and/or Au pellets. It was found that the mean size of nanoparticles for all composite thin films according to the results of transmission electron microscopy is less than 5 nm. The obtained films demonstrate tunable plasmon absorption band. The position of the localized surface plasmon resonance peak was experimentally observed at 435, 494, and 582 nm for $Ag-WO_{3-x}$, $Ag/Au-WO_{3-x}$ and $Au-WO_{3-x}$ composite thin films, respectively. Blueshift of the localized surface plasmon resonance band in contrast with the results of Mie calculations for $Ag-WO_{3-x}$ film was explained by possible formation of oxide shell on the surface of Ag nanoparticles. | Prikhodko, O., Dosseke, U., Nemkayeva, R., Guseinov, N., Mukhametkarimov, Y. / Thin Solid Films, 2022/ ISSN 00406090 / DOI 10.1016/j.tsf.2022.139387 / Том 7571 September 2022 Номер статьи 139387 / https://www.scopus.com/record/display.uri?eid=2-s2.0-85134432659&origin=resultslist&sort=plf-f |
| 50. | Size-Dependent Phonon-Assisted Anti-Stokes Photoluminescence in Nanocrystals of Organometal Perovskites | DOI 10.3390/nano12183184 | Anti-Stokes photoluminescence (ASPL), which is an up-conversion phonon-assisted process of the radiative recombination of photoexcited charge carriers, was investigated in methylammonium lead bromide (MALB) perovskite nanocrystals (NCs) with mean sizes that varied from about 6 to 120 nm. The structure properties of the MALB NCs were investigated by means of the scanning and transmission electron microscopy, X-ray diffraction and Raman spectroscopy. ASPL spectra of MALB NCs were measured under near-resonant laser excitation with a photon energy of 2.33 eV and they were compared with the results of the | Sekerbayev, K., Taurbayev, Y., Mussabek, G., Utegulov, Z., Timoshenko, V.Y. / Nanomaterials, 2022 / ISSN 20794991 / DOI 10.3390/nano12183184 / Том 12, Выпуск 18September 2022 Номер статьи 3184 / https://www.scopus.com/record/display.uri?eid=2-s2.0- |

| | | | photoluminescence (PL) measurements under non-resonant excitation at 3.06 eV to reveal a contribution of phonon-assisted processes in ASPL. MALB NCs with a mean size of about 6 nm were found to demonstrate the most efficient ASPL, which is explained by an enhanced contribution of the phonon absorption process during the photoexcitation of small NCs. The obtained results can be useful for the application of nanocrystalline organometal perovskites in optoelectronic and all-optical solid-state cooling devices. | 85138702312&origin=resultslist&sort=plf-f |
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| 51. | Luminescent carbon nanoparticles immobilized in polymer hydrogels for pH sensing | DOI 10.1007/s13204-022-02536-0 | Luminescent O, N-containing carbon nanoparticles (O, N-CNPs) were synthesized by the one-step method. Their surface chemistry was studied by TPD-MS, TGA, and 1H NMR. Different groups, carboxyl, imide, and amide groups, were found. The small (O, N)-CNPs dispersed in water have a high quantum yield of 0.26 with respect to quinine sulfate in 0.05 M sulfuric acid. We investigated the change in the fluorescence emission intensity using a titration of a colloidal solution of (O, N)-CNPs with unimolar solutions of KOH, HCl, or NaCl. The quenching efficiency strongly depends on the pH and is less dependent on the content of indifferent electrolytes. The small (O, N)-CNPs showed high fluorescence emission intensity in a neutral buffer in a Krebs solution. Besides, they showed a pronounced pH-dependent fluorescence quenching at acidic pH levels. These small (O, N)-CNPs are promising materials for biomedical applications as fluorescent probes with high acidic sensitivity because of high stability and high intensive fluorescence in a complex water matrix. With this aim, polymer hybrid hydrogels for wound dressings were modified with (O, N)-CNPs. Some of the obtained | Diyuk, N.V., Keda, T.Y., Zaderko, A.N., Kutsevol, N.V., Lisnyak, V.V. Mussabek, G. / Applied Nanoscience (Switzerland), 2022 / ISSN 21905509 / DOI 10.1007/s13204-022-02536-0 / Том 12, Выпуск 8, Страницы 2357 - 2365August 2022 / https://www.scopus.com/record/display.uri?eid=2-s2.0-85133234405&origin=resultslist&sort=plf-f |

| | | | composites are potentially effective for fluorescence pH-sensitive testing and the screening monitoring of wound healing. | |
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| 52. | Photo- and Radiofrequency-Induced Heating of Photoluminescent Colloidal Carbon Dots | DOI<br><br>10.3390/nano12142426 | Nitrogen- and oxygen-containing carbon nanoparticles (O, N-CDs) were prepared by a facile one-step solvothermal method using urea and citric acid precursors. This method is cost-effective and easily scalable, and the resulting O, N-CDs can be used without additional functionalization and sample pretreatment. The structure of O, N-CDs was characterized by TEM, AFM, Raman, UV-vis, and FTIR spectroscopies. The obtained O, N-CDs with a mean diameter of 4.4 nm can be easily dispersed in aqueous solutions. The colloidal aqueous solutions of O, N-CDs show significant photothermal responses under red-IR and radiofrequency (RF) irradiations. The as-prepared O, N-CDs have a bright temperature-dependent photoluminescence (PL). PL/PLE spectral maps were shown to be used for temperature evaluation purposes in the range of 30–50 °C. In such a way, the O, N-CDs could be used for biomedicine-related applications such as hyperthermia with simultaneous temperature estimation with PL imaging. | Mussabek, G., Zhylkybayeva, N., Lysenko, I., Lisnyak, V.V., Lysenko, V. / Nanomaterials, 2022 / ISSN<br><br>20794991 / DOI<br><br>10.3390/nano12142426 / Том 12, Выпуск 14July 2022 Номер статьи 2426 /<br><br>https://www.scopus.com/record/display.uri?eid=2-s2.0-85137339349&origin=resultslist&sort=plf-f |
| 53. | Preparation and characterization of F-, O-, and N-containing carbon nanoparticles for pH sensing | DOI<br><br>10.1007/s13204-021-01725-7 | A novel sensing system was designed for pH measurements based on the enhanced and quenched photoluminescence (PL) and UV–Vis absorption of the diluted water solutions of F-, O-, and N-containing carbon nanoparticles (FON-CNPs). These FON-CNPs were solvothermally synthesized, dissolved, ultra-filtrated, and separated by thin-layer chromatography. The total fluorine content in them was found to be 1.2–1.5 mmol per gram. Their TGA showed a total weight | Lisnyak, V.V., Zaderko, A.N., Mariychuk, R., Zhylkybayeva, N., Tananiko, O.Y. / Applied Nanoscience (Switzerland), 2022 / ISSN<br><br>21905509 / DOI<br><br>10.1007/s13204-021-01725-7 / Том 12, Выпуск 3, Страницы 795 - |

| | | | loss of 52.7% because of the thermal decomposition and detachment of the surface groups and the partial burning of the functionalized shell on the carbon core at temperatures below 1200 °C. TEM and Raman data confirmed the presence of graphitic structures in the carbon core. From the results of ATR FTIR and UV–Vis spectroscopies, we showed that a carbon shell incorporates different functional groups covering the carbon core. The surface groups of the carbon shell include carboxyl, phenolic, and carbonyl groups. Heterocyclic N-containing and amino groups and trifluoromethyl groups supporting the hydrophobicity were also found. We suggested the possible reasons for the pH responses obtained with the sensing system considering them dependent on the de-protonation of functional groups with pH change. | 803March 2022 / https://www.scopus.com/record/display.uri?eid=2-s2.0-85101098654&origin=resultslist&sort=plf-f |
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| 54. | Application of the Photoacoustic Approach in the Characterization of Nanostructured Materials | DOI 10.3390/nano12040708 | A new generation of sensors can be engineered based on the sensing of several markers to satisfy the conditions of the multimodal detection principle. From this point of view, photoacoustic-based sensing approaches are essential. The photoacoustic effect relies on the generation of light-induced deformation (pressure) perturbations in media, which is essential for sensing applications since the photoacoustic response is formed due to a contrast in the optical, thermal, and acoustical properties. It is also particularly important to mention that photoacoustic light-based approaches are flexible enough for the measurement of thermal/elastic parameters. Moreover, the photoacoustic approach can be used for imaging and visualization in material research and biomedical applications. The advantages of photoacoustic devices are their compact sizes and the | Isaiev, M., Mussabek, G., Lishchuk, P., Lacroix, D., Lysenko, V. / Nanomaterials, 2022 / ISSN 20794991 / DOI 10.3390/nano12040708 / Том 12, Выпуск 4February-2 2022 Номер статьи 708 / https://www.scopus.com/record/display.uri?eid=2-s2.0-85125570136&origin=resultslist&sort=plf-f |

| | | | possibility of on-site measurements, enabling the online monitoring of material parameters. The latter has significance for the development of various sensing applications, including biomedical ones, such as monitoring of the biodistribution of biomolecules. To extend sensing abilities and to find reliable measurement conditions, one needs to clearly understand all the phenomena taking place during energy transformation during photoacoustic signal formation. Therefore, the current paper is devoted to an overview of the main measurement principles used in the photoacoustic setup configurations, with a special focus on the key physical parameters. | |
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| 55. | Study of the influence of palladium nanoparticles on the structure of DLC films synthesized on silicon (100) substrates | DOI 10.1016/j.diamond.2022.109125 | This work reports about the study of the structure of films of amorphous diamond-like carbon modified with palladium nanoparticles and synthesized on silicon (100) substrates (a-C <Pdx>). Results of Raman studies indicate the change in the ratio of sp2/sp3 sites depending on the Pd concentration in the carbon films. It was found that palladium nanoparticles affect the formation of carbon bonds and increase the number of sp2 sites, and at concentrations of more than 1 at.%, the film structure becomes graphite-like. In addition, atomic force microscopy methods revealed the effect of palladium on the surface morphology of a-C <Pdx> films and non-uniform distribution of electron density. The size of the particles which form the structure of the a-C <Pdx> films was estimated by using the "threshold method of grains analysis" program. | Ryaguzov, A.P., Assembayeva, A.R., Myrzabekova, M.M., Nemkayeva, R.R., Guseinov, N.R. / Diamond and Related Materials, 2022 / ISSN 09259635 / DOI 10.1016/j.diamond.2022.109125 / Том 126June 2022 Номер статьи 109125 / https://www.scopus.com/record/display.uri?eid=2-s2.0-85131421026&origin=resultslist&sort=plf-f |

| 56. | Development of a System for Detecting Traveling Ionospheric Disturbances Based on GNSS Data | DOI 10.3390/atmos13020183 | The large amount of data that are available for ionospheric studies using the GPS TEC method, as well as the need to take into account complex atmospheric dynamics, create certain difficulties in automating the process of searching and recognizing traveling ionospheric disturbances generated by different sources. To automate the process of detecting wave disturbances, numerical criteria for assessing the level of the wave disturbance signal were proposed. The signal-to-noise ratio calculated by the proposed method was used as one of such criteria. This work contains a description of the developed software system that implements the proposed methodology and allows the loading of RINEX files and processing, analyzing, and visualizing total electron content data. | Andreyev, A., Kapytin, V., Mukasheva, S., Somsikov, V./ Atmosphere, 2022, 13(2), 183 / DOI 10.3390/atmos13020183 / ISSN 20734433 / Том 13, Выпуск 2February 2022 Номер статьи 183 / https://www.scopus.com/record/display.uri?eid=2-s2.0-85124953811&origin=resultslist&sort=plf-f |
| 57. | The Influence of the Initial Charge Compaction on the Radiation Synthesis of YAG:Ce Ceramics | DOI 10.1007/s11182-022-02508-5 | It is shown that the morphology of the YAG:Ce ceramic samples synthesized in the field of high-energy electron flux depends on the degree of compaction of the initial charge of Y, Al, Ce oxides. The fraction of the YAG phase is higher in the samples of ceramics formed from the compacted charge. The spectral luminescence characteristics of the samples, synthesized from a mixture of the same compositions, do not depend on the compaction degree. | Ermolayev, A.V., Tulegenova, A.T., Lisitsyna, L.A., Korzhneva, T.G., Lisitsyn, V.M. / Russian Physics Journal, 2022, 64(9), стр. 1692–1696 / DOI 10.1007/s11182-022-02508-5 / ISSN 10648887 / Том 64, Выпуск 9, Страницы 1692 - 1696January 2022 / https://www.scopus.com/record/display.uri?eid=2-s2.0-85123073465&origin=resultslist&sort=plf-f |

| 58. | Toward Understanding the B[e] Phenomenon. IX. Nature and Binarity of MWC645 | DOI 10.3847/1538-4357/ac87a1 | We present the results of optical and near-IR spectroscopy and multicolor photometry of the emission-line star MWC 645, which exhibits the B[e] phenomenon. The presence of positionally variable absorption lines of a cool star detected for the first time indicates that the object is a binary system. Using a combination of the photometric and spectroscopic data as well as the Gaia EDR3 distance ($D = 6.5 \pm 0.9$ kpc), we disentangled the components' contributions and estimated their surface temperatures and luminosities ($18,000 \pm 2000$ K and $4250 \pm 250$ K, log $L/L_\odot = 4.0 \pm 0.5$ and $3.1 \pm 0.3$ for the hot and cool components, respectively). Quasi-cyclic short-period (months) and long-period ($\sim$4 yr) photometric variations were detected in both optical and near-IR regions, and are most likely due to variable circumstellar extinction. Our analysis suggests that MWC 645 is a member of the FS CMa group. The object's properties can be described by an evolutionary model of a close binary system that currently undergoes a nonconservative mass transfer between intermediate-mass stars (e.g., $7 M_\odot + 2.8 M_\odot$). | Nodyarov, A.S., Miroshnichenko, A.S., Khokhlov, S.A., Omarov, C.T., Kokumbaeva, R.I. / Astrophysical Journal, 2022, 936(2), 129 / DOI 10.3847/1538-4357/ac87a1 / ISSN 0004637X / Том 936, Выпуск 21 September 2022 Номер статьи 129 / https://www.scopus.com/record/display.uri?eid=2-s2.0-85138200946&origin=resultslist&sort=plf-f |
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| 59. | Performance simulation of eco-friendly solar cells based on $CH_3NH_3SnI_3$ | https://doi.org/10.31489/2022No2 | Large-scale deployment of the perovskite photovoltaic technology using such high-performance materials as $CH_3NH_3PbI_3$ may face serious environmental issues in the future. Implementation of perovskite solar cell based on Sn could be an alternative solution for commercialisation. This paper presents the results of a theoretical study of a lead-free, environmentally-friendly photovoltaic cell using $CH_3NH_3SnI_3$ as a light-absorbing layer. The characteristics of a photovoltaic cell based on perovskite were modelled using the SCAPS-1D | **Yerezhep, D., Aldiyarov, A.,** Golikov, O., Tokmoldin, N. Performance simulation of eco-friendly solar cells based on $CH_3NH_3SnI_3$ // Eurasian Physical Technical Journal, 2022, 19(2), стр. 58–64 https://doi.org/10.31489/2022No2 |

| | | | program. Various thicknesses of the absorbing layer were analysed, and an optimised device structure is proposed, demonstrating a high power conversion efficiency of up to 28% at ambient temperature. The analysis of the thicknesses of the $CH_3NH_3SnI_3$ absorbing layer revealed that at a thickness of 500 nm, performance is demonstrated with an efficiency of 27.41 %, a fill factor of 85.92 %, a short circuit current density of 32.60 mA/cm$^2$ and an open-circuit voltage of 0.98 V. The obtained numerical results indicate that the $CH_3NH_3SnI_3$ absorbing layer may be a viable replacement for the standard materials and may form the basis of a highly efficient technology of the environmentally-friendly perovskite solar cells. | |
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| 60. | In Silico Investigation of the Impact of Hole-Transport Layers on the Performance of $CH_3NH_3SnI_3$ Perovskite Photovoltaic Cells | https://doi.org/10.3390/cryst12050699 | Perovskite solar cells represent one of the recent success stories in photovoltaics. The device efficiency has been steadily increasing over the past years, but further work is needed to enhance the performance, for example, through the reduction of defects to prevent carrier recombination. SCAPS-1D simulations were performed to assess efficiency limits and identify approaches to decrease the impact of defects, through the selection of an optimal hole-transport material and a hole-collecting electrode. Particular attention was given to evaluation of the influence of bulk defects within light-absorbing $CH_3NH_3SnI_3$ layers. In addition, the study demonstrates the influence of interface defects at the $TiO_2/CH_3NH_3SnI_3$ (IL1) and $CH_3NH_3SnI_3$/HTL (IL2) interfaces across the similar range of defect densities. Finally, the optimal device architecture $TiO_2/CH_3NH_3SnI_3/Cu_2O$ is proposed for the given absorber layer using the readily available $Cu_2O$ hole- | **Omarova, Z., Yerezhep, D., Aldiyarov, A.,** Tokmoldin, N. In Silico Investigation of the Impact of Hole-Transport Layers on the Performance of $CH_3NH_3SnI_3$ Perovskite Photovoltaic Cells // Crystals, 2022, 12(5), 699  https://doi.org/10.3390/cryst12050699 |

| | | | transporting material with PCE = 27.95%, FF = 84.05%, $V_{OC} = 1.02$ V and $J_{SC} = 32.60$ mA/cm$^2$, providing optimal performance and enhanced resistance to defects. | |
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| 61. | Natural Material Shungite as Solid-Phase Extraction Sorbent for the Extraction of Red Synthetic Dye Ponceau 4R from Tap Water, Wine, and Juice | https://doi.org/10.1007/s12161-021-02162-6 | A natural nanomaterial shungite (NMSh) was used as solid-phase extraction (SPE) absorbent and showed excellent absorption capacity for red synthetic dye. NMSh is a mixture of various carbon allotropes, which is used as an inexpensive and effective sorbent in various scientific and food research around the world. NMSh is not just amorphous carbon, but the mixture of various carbon allotropes; shungite has been categorized as a promising material for the development of nanotechnology, which is of great interest for the development of science and technology. This fact served as the basis for selecting shungite as a material to create sorbents that will be used in the preparation of samples for analysis. For the determination of the red synthetic dye Ponceau 4R in samples of wine and juice, an SPE method with NMSh packed cartridge combined with HPLC–UV detection was developed to determine Ponceau 4R in tap water, wine, and juice samples. Particle size and mass of NMSh sorbent were studied, and a comparison between activated and non-activated NMSh was made for use as a sorbent. Under optimized conditions, the extraction of analyte was 99.3% for wine and 94.3% for juice with relative standard deviations (RSD) during the day equal to 0.18% for juice and 0.15% for wine. The results showed that this method is very sensitive and effective for the determination of food dyes in very complex matrices and in a low concentration. Based on the study was developed the | Alham, A., Ibraimov, A., **Alimzhanova, M., Mamedova, M.** Natural Material Shungite as Solid-Phase Extraction Sorbent for the Extraction of Red Synthetic Dye Ponceau 4R from Tap Water, Wine, and Juice // Food Analytical Methods, 2022, 15(3), стр. 707–716<br><br>https://doi.org/10.1007/s12161-021-02162-6 |

| | | | method to determine the dyes in alcoholic and non-alcoholic drinks | |
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| 62. | Investigation of CO2 Extract of Portulaca oleracea for Antioxidant Activity from Raw Material Cultivated in Kazakhstan | https://doi.org/10.1155/2022/6478977 | Medicinal plants remain as an important resource in the fight against many diseases, especially in developing countries. Antioxidants are substances capable of delaying, retarding, and preventing the oxidation of lipids or substances that delay or prevent free radical reactions during lipid oxidation. Natural antioxidants such as ascorbic acid, tocopherol, phenolic compounds, and flavonoids are a safe alternative to chemical antioxidants. In present work, results of antioxidant activity of raw materials from the cultivated plant Portulaca oleracea are presented. The extraction time was optimized to 780 minutes; the yield of extractive substances was 1.25% in the production of CO2 extract under subcritical conditions. For the first time, the antioxidant activity of Portulaca oleracea CO2 extract was determined by the amperometric method. Gas chromatography-mass spectrometry (GC-MS) chemical analysis of Portulaca oleracea CO2 extract dissolved in hexane revealed 37 components, including a complex mixture of aldehydes, alkanes, alkenes, esters, diterpenes, steroids, vitamin E, and carbohydrates. The investigation results showed that the Portulaca oleracea CO2 extract was promising for pharmaceutical, cosmetic, and food industries and had great potential for the prevention and treatment of diseases caused by oxidative stress. | Tleubayeva, M.I., Abdullabekova, R.M., Datkhayev, U., Ishmuratova, M.Yu., **Alimzhanova, M.B.,** Kozhanova, K.K., Seitaliyeva, A.M., Zhakipbekov, K.S., Iskakova, Zh.B., Serikbayeva, E.A., Flisyuk, E.V. Investigation of CO2Extract of Portulaca oleracea for Antioxidant Activity from Raw Material Cultivated in Kazakhstan // International Journal of Biomaterials, 2022, 2022, 6478977 <br><br> https://doi.org/10.1155/2022/6478977 |
| 63. | Modern Analytical Methods for the Analysis of | https://doi.org/10.3390/foods11111623 | Currently, research on the determination of pesticides in food products is very popular. Information obtained from research conducted so far mainly concerns the development of a methodology to determine the content | Syrgabek, Y., **Alimzhanova, M.** Modern Analytical Methods for the |

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| | Pesticides in Grapes: A Review | | of pesticides in food products. However, they do not describe the content of the pesticide used in viticulture in the resulting product. Over the past decade, this study has examined analytical methodologies for assessing pesticide residues in grapes. Scopus, Web of Science, Science Direct, PubMed, and Springer databases were searched for relevant publications. The phrases "pesticides" and "grapes" and their combinations were used to search for articles. The titles and annotations of the extracted articles have been read and studied to ensure that they meet the review criteria. The selected articles were used to compile a systematic review based on scientific research and reliable sources. The need to study the detection of pesticide residues in grapes using advanced analytical methods is confirmed by our systematic review. This review also highlights modern methods of sample preparation, such as QuEChERS, SPME, PLE, dLLME, and ADLL-ME, as well as the most used methods of separation and identification of pesticides in grapes. An overview of the countries where residual grape pesticide amounts are most studied is presented, along with the data on commonly used pesticides to control pests and diseases in grape cultivation. Finally, future possibilities and trends in the analysis of pesticide residues in grapes are discussed by various analytical methods. | Analysis of Pesticides in Grapes: A Review // Foods, 2022, 11(11), 1623 https://doi.org/10.3390/foods11111623 |
| 64. | Miniaturized solid-phase microextraction coupled with gas chromatography-mass spectrometry | https://doi.org/10.1016/j.fochx.2022.100345 | A simple and rapid method based on miniaturized solid-phase microextraction (mini-SPME) followed by gas chromatography–mass spectrometry was developed to identify eight endocrine disruptors (atrazine, diethylstilbestrol, hexestrol, estrone, estradiol, ethinylestradiol, norgestrel, and megestrel) in drinking | **Alimzhanova, M., Mamedova, M.**, Ashimuly, K., Alipuly, A., Adilbekov, Y. Miniaturized solid-phase microextraction coupled with gas chromatography-mass spectrometry for determination of |

| | | | water samples. Extraction parameters was optimized and further analyses was performed using them. The optimum temperature for the determination of endocrine disruptors in water was 80 °C; the optimum extraction and preincubation times were 60 and 20 min, respectively. The studied linear range of endocrine disruptors was 10.0–1000 $\mu g\ mL^{-1}$. The limit of detection ranged from 0.020 to 0.087 $\mu g\ mL^{-1}$. The correlation coefficient ($r^2$) was 0.96–0.99. This research introduces a novel method for detecting analytes at extremely low concentrations, as well as the possibility of combining several detection technologies to give high-accuracy qualitative and quantitative determination of endocrine disruptors in aqueous samples. | endocrine disruptors in drinking water // Food Chemistry: X, 2022, 14, 100345 <br><br> https://doi.org/10.1016/j.fochx.2022.100345 |
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| for determination of endocrine disruptors in drinking water | | | | |
| 65. | Influence of the method of air-fuel mixture supply on the main characteristics of heat and mass transfer processes | https://doi.org/10.1134/S0869864322010097 | Computational experiments were carried out using three-dimensional computer modeling methods to determine the effect of various burner arrangements and the method of fuel mixture supply on the main characteristics of heat and mass transfer processes (flow aerodynamics, temperature fields, concentration fields of combustion products) throughout the entire volume of the combustion chamber of a power boiler and at its outlet. It is shown that the use of vortex burners with a swirl of the air mixture flow allows improvement of metabolic processes in the combustion chamber and reduces emissions of harmful substances into the atmosphere both during traditional fuel combustion and at reduced boiler load (partial shutdown of burners). | **Askarova, A.S., Messerle, V.E., Bolegenova, S.A., Maksimov, V. Yu., Bolegenova, S.A., Nugymanova, A.O.** Influence of the method of air-fuel mixture supply on the main characteristics of heat and mass transfer processes // Thermophysics and Aeromechanics, 2022, 29(1), стр. 107–124 <br><br> https://doi.org/10.1134/S0869864322010097 |
| 66. | A Review of the Energy Potential of Residual Biomass | https://doi.org/10.3390/en15176482 | Although it has access to hydrocarbon reserves, Kazakhstan has developed a strategy for the transition to a low-carbon economy, which should include the use of renewable energy sources. In this framework, the use of | **Askarova, A.,** Zamorano, M., Martín-Pascual, J., **Nugymanova, A., Bolegenova, S.** A Review of the Energy Potential of Residual |

| | | | biomass from waste could have the potential to reduce emissions from traditionally fueled energy generation, as well as adding value to the generated waste, which also improves waste management according to the principles of a circular economy. The analysis of the resources and energy potential from residual biomass in Kazakhstan presents an annual production of $37.26 \times 10^6$ tons of residual biomass, which could be capable of producing an energy potential of 466.74 PJ/year, little more than half to the total production from all the installed power plants in the country. Agricultural, animal and municipal solid waste are available to produce energy in Kazakhstan based on combustion technologies; however, animal waste and agricultural are the main potential sources with 61.02% and 38.34% of the theoretical total biomass potential energy analyses, respectively. Considering that 80% of Kazakhstan's electricity generation comes from coal-fired plants, energy from agriculture could be co-fired for the gradual replacement of coal with biomass in operational power plants, without substantially increasing costs or infrastructure investments, thereby making the transition to a low-carbon economy and renewable energy sources in the country easier. | Biomass for Coincineration in Kazakhstan // Energies, 2022, 15(17), 6482<br><br>https://doi.org/10.3390/en15176482 |
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| for Coincineration in Kazakhstan | | | | |
| 67. | Computational modeling of pollutants in furnaces of pulverized coal boilers of the republic of Kazakhstan | https://doi.org/10.1016/j.energy.2022.124826 | Ecological situation in the world has forced to close coal plants. And renewable energy sources, which are characterized by volatility, mayn't be enough to provide countries with energy, so transition to "green energy" will be difficult. Kazakhstan's energy industry will gradually switch from coal to gas so that emissions correspond to European standards, but coal will remain the main fuel for the time being due to its cheapness. In | **Askarova, A.**, Georgiev, A., **Bolegenova, S., Beketayeva M., Maximov, V., Bolegenova, S**. Computational modeling of pollutants in furnaces of pulverized coal boilers of the republic of Kazakhstan // Energy, 2022, 258, 124826 |

| | | | this regard power units of energy plants require creating and mastering of new environmentally friendly coal technologies to reduce the negative impact on the environment. Pollutants formation depends on fuel type and conditions of burning. Thus a detailed study of the heat-mass transfer processes in combustion system is relevant. In proposed work, computational modelling of pollutants formation during burning of low-grade coal (A~40%) was carried out. Proposed work is aimed at defining of the new physical, mathematical and chemical models, which were adapted and implemented into the CFD code. The results of the study showed a good correspondence of the numerical experiment with natural data. The proposed model can be useful in any energy systems running on low-grade fuel to obtain relevant data that contribute to the control of environmental pollution. | https://doi.org/10.1016/j.energy.2022.124826 |
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| 68. | Radiation-stimulated adsorption processes on the surface of beryllium oxide | http://dx.doi.org/10.15826/chimtech.2022.9.1.06 | The paper presents the study results of photo and gamma radiation effect on the beryllium oxide (BeO) surface properties. Photoadsorption studies of O2 on BeO by the methods of infrared (IR) spectroscopy and manometry with a change in the temperature of preliminary annealing from 473 to 1073 K show that samples subjected to preliminary training at 473 K are most active. The maximum of adsorption activity on γ-irradiated beryllium oxide is observed on the samples annealed at 673 K before the irradiation. The maximum of paramagnetic centers (PMCs) is also observed on samples annealed at this temperature. Comparison of electron paramagnetic resonance (EPR) and adsorption studies shows that absorption of H2 and O2 leads to the destruction of paramagnetic centers. It is assumed that, | **Tusseyev, T.T., Danlybaeva, A.K.,** Raimkul, S.S., **Kiykabaeva, A.A., Doszhanov, O.M**. Radiation-stimulated adsorption processes on the surface of beryllium oxide // Chimica Techno Acta, 2022, 9(1), 20229106<br><br>http://dx.doi.org/10.15826/chimtech.2022.9.1.06 |

| | | | upon irradiation, adsorption centers with electron and hole modes are formed on the surface of BeO. | |
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| 69. | The Effect of the Cryosurface Materials on the Cryoemission Parameters of Some Gases | https://doi.org/10.1007/s10909-021-02648-x | The results obtained are an experimental confirmation of the effect of the cryosurface material on the process of the onset of cryocondensation radiation during the condensation of gases such as nitrous oxide, ethanol, and methanol. It is shown that regardless of the material of the optical system of the surface, whether it is a metal mirror or a mirror covered with a film of the cryocondensates of a dielectric having an intrinsic dipole moment or with a zero-dipole moment while maintaining the thermodynamic parameters and formation conditions, the cryoradiation process will exist in the visible spectral range. This fact is a constructive proof of selection and calculation of low-temperature surfaces in specific conditions of their functioning. | **Korshikov, E., Sokolov, D**. The Effect of the Cryosurface Materials on the Cryoemission Parameters of Some Gases // Journal of Low Temperature Physics, 2022, 206(3-4), стр. 199–209 <br><br> https://doi.org/10.1007/s10909-021-02648-x |
| 70. | Convective mass transfer of a binary gas mixture in an inclined channel | https://doi.org/10.1002/zamm.201900197 | The influence of a slope angle on the stability of mechanical equilibrium in binary gaseous mixtures has been investigated both experimentally and numerically. Experimental studies have shown that the angle of inclination of the channel relative to the horizontal plane can be critical in convective mixing. When this angle is reached, the system performs a kinetic transition from an unstable to a stable state, that is, to diffusion. The problem is solved by the Lattice Boltzmann method using the two-dimensional Navier-Stokes equation, the continuity equation and the equation of concentration. Calculations are performed to study binary mixtures with different angles of inclination of the diffusion channel with respect to the vertical axis. Due to the increase of the angle of inclination, the convective flow | **Kossov, V., Fedorenko, O.,** Zhakebayev, D., **Mukamedenkyzy, V.,** Kulzhanov, D. Convective mass transfer of a binary gas mixture in an inclined channel // ZAMM Zeitschrift fur Angewandte Mathematik und Mechanik, 2022, 102(1), e201900197 <br><br> https://doi.org/10.1002/zamm.201900197 |

| | | | intensity decreases. Numerical data on the structure fields of concentrations at different times depending on the increase of the slope angle are obtained. | |
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| 71. | Multicomponent mixing on the "diffusion – convection" transition boundary at elevated pressures | https://doi.org/10.1088/1742-6596/2150/1/012014 | An experimental and theoretical study of three-component mixing at the "diffusion – convection" boundary at elevated pressures is carried out. It is shown that the pressure dependence of the dimensionless parameter α, defined as the ratio of the experimental values of the component concentrations to those calculated by the Stefan-Maxwell equations, has characteristic regions due to the interaction of structural formations moving towards each other, in which a transition from one critical motion to another occurs. Within the framework of a linear analysis of the stability of a ternary gas mixture for a vertical circular cylinder channel, it is shown that scale perturbations determining the transition from one type of flow to another correspond to a certain value of the perturbation mode n and the critical Rayleigh numbers. | **Kossov, V.N., Fedorenko, O.V.**, Zhaneli, M., Mukhatova, K. Multicomponent mixing on the "diffusion – convection" transition boundary at elevated pressures // Journal of Physics: Conference Series, 2022, 2150(1), 012014<br><br>https://doi.org/10.1088/1742-6596/2150/1/012014 |
| 72. | Plasma ignition of solid fuels at thermal power plants. Part 1. Mathematical modeling of plasma-fuel system | https://doi.org/10.1134/S0869864322020135 | One of the promising ignition technologies is the plasma thermochemical preparation of pulverized coal for combustion using plasma-fuel systems (PFS). This technology allows increasing the efficiency of fuel application and improving the environmental performance of thermal power plants, as well as eliminating fuel oil, used traditionally to ignite boilers and stabilize combustion of a pulverized coal flame. This paper presents the numerical results on ignition of a pulverized coal flame in a PFS. The plasma-fuel system is designed for oil-free start-up of boilers and stabilization of flame combustion and this is a pulverized coal burner equipped with a plasma torch. In | **Messerle, V.E.**, Ustimenko, A.B., **Tastanbekov, A.K.** Plasma ignition of solid fuels at thermal power plants. Part 1. Mathematical modeling of plasma-fuel system // Thermophysics and Aeromechanics, 2022, 29(2), стр. 295–310<br><br>https://doi.org/10.1134/S0869864322020135 |

addition to plasma torch electric power and ash content in coal, one of the main operating parameters of PTS, which ensures fuel ignition, is concentration of coal dust in the aeromixture, which can be varied over a wide range. The conditions of fuel mixture ignition in the PFS were determined for three above-mentioned operating parameters of PFS using the PlasmaKinTherm program, which combines kinetic and thermodynamic methods for calculating the processes of motion, heating, and thermochemical transformations. The calculations were performed for a cylindrical PFS with a diameter of 0.2 m and a length of 2 m. The coal consumption was 1000 kg/h. The conditions of fuel mixture ignition in the PFS were studied depending on the plasma-torch power (20–100 kW), coal concentration in the fuel mixture in the range from 0.4 to 1.8 kg of coal per 1 kg of air, and also for three different values of coal ash content (20, 40, and 70 %). The main regularities of the process of plasma thermochemical preparation of fuel for combustion have been revealed.

| 73. | A comprehensive kinetic modeling study of hydrogen combustion with uncertainty quantification | https://doi.org/10.1016/j.fuel.2022.123705 | A 19-reactions $H_2$ oxidation chemical kinetic model has been optimized with uncertainty quantification. The uncertainties of the reaction rate constant (RRC) parameters have been first estimated based on the recommended direct measurements and review works. This deterministic approach was further combined with the probabilistic treatment of RRC to decrease the uncertainty intervals and to extend the temperature validity range for RRCs with the highest uncertainty level, for which two quantities, discrepancy measures and uncertainty contributions, were introduced in the developed framework. Monte Carlo simulations with | Wang, H., **Slavinskaya, N**., Haidn, O. A comprehensive kinetic modeling study of hydrogen combustion with uncertainty quantification // Fuel, 2022, 319, 123705 https://doi.org/10.1016/j.fuel.2022.123705 |

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| 75. | The effect of magnetic field on diffusion and drift of electrons in helium and xenon | DOI 10.1063/5.0078333 | In this work, kinetic characteristics of the electron drift are calculated by the Monte Carlo method in two inert gases (He and Xe) at an electric field strength $E/N = 30$ $100$ Td, and a magnetic field induction up to 1 T at a gas density of $10^{17}$ atoms per cm3. The results of calculations of the electron drift characteristics in helium and xenon in constant and uniform electric and magnetic fields are presented. The methods of numerical simulation are used to obtain the main characteristics of the electron drift and the diffusion coefficients. It is shown that accounting for the magnetic field leads to a decrease in the drift velocity and mean energy of the electrons. The results of the calculation can be used for the | Maiorov S.A., Kodanova S. K., Bastykova N. Kh., Omiraliyeva, G.K., Ramazanov T. S.<br><br>Physics of Plasmas 29, 043502 (2022)<br><br>IF 2.023, Q2<br>Scopus - сведения о документе - The effect of magnetic field on diffusion and drift of electrons in helium and xenon |

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randomly sampled RRCs and polynomial regression were performed to develop the response surface with high coefficients of determination to be utilized in the model optimization procedure.10 key channels were selected for further optimization, and the probability density functions were calculated on the basis of discrepancy measures for 4 channels to reduce their large uncertainty intervals. The training set was collected from carefully validated measured data following experiments of shock tubes, rapid compression machines, jet stirred reactors, plug flow reactors, and premixed laminar flames. Inconsistent experimental targets were fixed and excluded from considerations. The optimized chemical kinetic model demonstrates good predicting ability for the $H_2$ combustion experimental data from both the training set and the conditions outside the tested range (blind modeling).

| | | | analysis of experimental data on electron drift and diffusion in crossed electric and magnetic fields. | |
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| 76. | Investigation of the influence of single-particle oscillations on the transport properties of dense plasma | DOI 10.1002/ctpp.2022000 18 | Transport properties of the ionic component of dense plasmas are investigated on the basis of effective potentials taking into account the presence of an external alternating electrical (laser) field. The latter generates single-particle oscillations of electrons and significantly changes the screening of the test charge in plasma. Therefore, transport coefficients become non-monotonic function of the oscillation frequency. The results for the diffusion and viscosity coefficients are presented. These transport coefficients are computed using the generalized Coulomb logarithm within the Chapman-Enskog model for the fluid description. It was revealed that the oscillation of the electrons in the alternating external field with the frequency (Formula presented.) (with $\omega_p$ being plasma frequency) results in the significant reduction of the ionic diffusion and viscosity coefficients. In contrast, at (Formula presented.), the ionic diffusion and viscosity coefficients are larger compared to the case without the external field impact. | Kodanova S.K. Issanova M. K., Omiraliyeva G.K., Ramazanov T. S. CONTRIBUTIONS TO PLASMA PHYSICS, 2022, IF 1.563, Q3 DOI10.1002/ctpp.202200018 Scopus - сведения о документе - Investigation of the influence of single-particle oscillations on the transport properties of dense plasma |
| 77. | Carbon nanoparticles characteristics synthesized in pulsed radiofrequency discharge and their effect on surface hydrophobicity | DOI 10.1002/ctpp.2021002 38 | Carbon nanoparticles were synthesized using a 13.56 MHz radiofrequency (RF) discharge of $Ar/CH_4$ plasma in pulsed mode to control the nanoparticle size. Experimental observations have shown that the size of carbon nanoparticles increases with the frequency of the pulse signal. It was also found that by using a frequency modulated pulsed RF signal it is possible to control the size of carbon nanoparticles in the 40–70 nm range, where the plasma-enhanced chemical vapour deposition method is the main mechanism for nanoparticle growth. Transmission electron microscopy image analysis showed two types of nanoparticles, some of which are an agglomerate of nanoparticles with an amorphous structure, | Batryshev, D., Utegenov, A., Zhumadilov, R., Akhanova N., Orazbayev S., Ussenkhan S., Jiashu Lin, Kazuo Takahashi, Kodanova, S., Bastykova, N., Gabdullin, M., Ramazanov, T. Contributions to Plasma Physics, (2022) (https://doi.org/10.1002/ctpp.202100238) IF 1.563, Q3 |

| | | | | while the others are nanometre-sized with crystalline structures. Changes in the modulation frequency and synthesis time help to obtain different films with different values of the contact angle. | Scopus - сведения о документе - Carbon nanoparticles characteristics synthesized in pulsed radiofrequency discharge and their effect on surface hydrophobicity |
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| 78. | Ring dust structures in a weak inhomogeneous magnetic field | DOI 10.1002/ctpp.202100254 | | Experimental results on the influence of an external inhomogeneous magnetic field created in the end areas of the coil on the dynamics of a ring-shaped dust structure in a stratified glow discharge in argon are presented. The rotational behaviour of the ring was investigated at different magnetic fields in the range up to 16 mT. It was found that the direction of rotational motion of dust particles in an inhomogeneous magnetic field depends on the direction of its radial component. A theoretical model was proposed to explain the experimental observations. | Kodanova, S., Abdirakhmanov, A., D'yachkov, L., Bastykova, N., Ramazanov, T. Contributions to Plasma Physics, 2022<br><br>IF 1.563, Q3<br>Scopus - сведения о документе - Ring dust structures in a weak inhomogeneous magnetic field |
| 79. | Effective interaction potentials and the scattering cross sections of the Lorentzian dense semiclassical plasma particles | DOI 10.1016/j.physleta.2022.128313 | | Modified versions of the dynamic effective interaction potentials for the charged particles in dense semiclassical plasma are presented. These models consider dynamic screening, quantum mechanical effect of diffraction and particle velocity distribution function with non-Maxwellian suprathermal tail. Such distributions are well described by the so-called kappa-distribution and can be used in different space plasma and in some plasma installations where the suprathermal particles take place. Based on this modified dynamic interaction potentials the differential scattering cross sections of the electron-electron and electron-ion collisions were investigated. The obtained results for different values of the density parameter, coupling parameter and spectral index $\kappa$ are presented. | Seisembayeva, Madina M. Shalenov, Erik O.; Kossymkyzy, Zhansayaa Turekhanova; Jumagulov M.N.; Ramazanov T.S.; Dzhumagulova, K N.<br><br>*Physics Letters, Section A: General, Atomic and Solid State Physics* Том 44730 September 2022 Номер статьи 128313<br>Scopus - сведения о документе - Effective interaction potentials and the scattering cross sections of the |

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| | | | | [Lorentzian dense semiclassical plasma particles](#) |
| 80. | Investigation of self-generated magnetic field and dynamics of a pulsed plasma flow | DOI 10.1088/2058-6272/ac5018 | Due to the growing interest in studying the compression and disruption of the plasma filament in magnetic fusion devices and Z-pinches, this work may be important for new developments in the field of controlled thermonuclear fusion. Recently, on a coaxial plasma accelerator, we managed to obtain the relatively long-lived (a1/4300 μs) plasma filaments with its self-magnetic field. This was achieved after modification of the experimental setup by using high-capacitive and low-inductive energy storage capacitor banks, as well as electrical cables with low reactive impedance. Furthermore, we were able to avoid the reverse reflection of the plasma flux from the end of the plasma accelerator by installing a special plasma-Absorbing target. Thus, these constructive changes of the experimental setup allowed us to investigate the physical properties of the plasma filament by using the comprehensive diagnostics including Rogowski coil, magnetic probes, and Faraday cup. As a result, such important plasma parameters as density of ions and temperature of electrons in plasma flux, time dependent plasma filament's azimuthal magnetic field were measured in discharge gap and at a distance of 23.5 cm from the tip of the cathode. In addition, the current oscillograms and I-V characteristics of the plasma accelerator were obtained. In the experiments, we also observed the charge separation during the acceleration of plasma flow via oscillograms of electron and ion beam currents. | Tazhen, Aigerim; Dosbolayev, Merlan; Ramazanov, Tlekkabul<br><br>*Plasma Science and Technology*<br>Том 24, Выпуск 5May 2022 Номер статьи 055403<br>[Scopus - сведения о документе - Investigation of self-generated magnetic field and dynamics of a pulsed plasma flow](#) |
| 81. | Preliminary Study of the Solid-State Pulsed Plasma Thruster Model with | DOI 10.1134/S1063780X2 2030047 | Abstract: A preliminary test of the solid-state pulsed plasma thruster (PPT) model with graphite as a solid propellant to correct and maintain a small satellite's orbit was carried out. The structural, electrical and thrust characteristics of the solid-state PPT were experimentally investigated using the plasma | Dosbolayev M.K.; Igibayev, Zh. B.; Tazhen A.B.; Ramazanov T.S. |

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| | Graphite as a Propellant | | emission spectrum, Rogowski coil, and ballistic pendulum. Furthermore, the formation dynamics of the pulsed plasma was investigated by using a high-speed CMOS Phantom VEO710S camera. | *Plasma Physics Reports* Том 48, Выпуск 3, Страницы 263 - 270March 2022 <br> Scopus - сведения о документе - Preliminary Study of the Solid-State Pulsed Plasma Thruster Model with Graphite as a Propellant |
| 82. | Methods of theoretical calculations and of experimental researches of the system atomic hydrogen – metal | DOI 10.1016/j.ijhydene.2021.03.065 | All the main directions of energy development suggest or already implement the use of hydrogen. In addition, the interaction of low-energy hydrogen atoms with metals is also of considerable interest, both from the point of view of fundamental research and in connection with the operation of large tokamaks and thermonuclear reactors. The paper presents a literature review of the features of the interaction of hydrogen with metals. It is shown that metal-hydrogen reactions, which lead to the formation of metal hydrides, are considered as a special type of such interaction. Modern methods of experimental study of heterogeneous reactions, topochemistry of metal - hydrogen reactions, dependences of the rate of interaction on pressure and temperature are considered, models of surface processes occurring during the interaction of hydrogen with a metal are discussed. A kinetic method for studying the mechanism of interaction of atomic hydrogen with hydride-forming metals is proposed. | Zolotarenko, Al.D. Veziroglu A.; Veziroglu T.N.; Shvachko N.A.; Pomytkin A.P.; Schur D.V.; Gavrylyuk N.A.; Ramazanov T.S.; Akhanova N.Y.; Gabdullin M.T. <br><br> *International Journal of Hydrogen Energy*Том 47, Выпуск 11, Страницы 7310 - 73275 February 2022 <br> Scopus - сведения о документе - Methods of theoretical calculations and of experimental researches of the system atomic hydrogen – metal |
| 83. | The use of ultrapure molecular hydrogen enriched with atomic hydrogen in apparatuses of artificial lung ventilation in the | DOI 10.1016/j.ijhydene.2021.03.025 | COVID-19 is a disease caused by the SARS-CoV virus. It stands for severe acute respiratory syndrome, which affects the lungs. The process of replication and progression of the COVID-19 virus causes the formation of an excessive amount of reactive oxygen species and inflammation. Many studies have been carried out that have demonstrated that hydrogen has strong anti-inflammatory properties. It reduces hypotension and other symptoms by reducing inflammation | Zolotarenko, An.D.; Veziroglu A; Veziroglu T.N.; Shvachko N.A.; Pomytkin A.P.; Gavrylyuk N.A.; Schur D.V.; Ramazanov T.S.; Gabdullin M.T. |

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| | fight against virus COVID-19 | | and oxidative stress. Oxygen mixture, enriched with Hydrogen, - helps to reduce the resistance of the respiratory tract and frees up access to the pulmonary alveolus, which improves the penetration of oxygen into the lungs. Since hydrogen is an antioxidant, it helps to reduce the burden on the immune system, helps to maintain the body's health and its ability to quickly recover. When electrolysers are used to produce an oxygen-hydrogen mixture, alkaline mist and other impurities can enter the patient's lungs and cause poisoning and chemical burns. For this reason, the use of atomic hydrogen obtained from metal hydride sources for ventilation of the lungs will be more effective for treating COVID-19 than a molecular hydrogen-oxygen mixture from an electrolyzer. A functional diagram of a metal hydride source of atomic hydrogen to an artificial lung ventilator is shown. It is possible to create a series of hydrogen storage tanks of various capacities. | *International Journal of Hydrogen Energy*Открытый доступТом 47, Выпуск 11, Страницы 7281 - 72885 February 2022 Scopus - сведения о документе - The use of ultrapure molecular hydrogen enriched with atomic hydrogen in apparatuses of artificial lung ventilation in the fight against virus COVID-19 |
| 84. | Study of the electron-atom collisions in dense semiclassical plasma of noble gases | DOI 10.1017/S002237782 2000071 | We present the effective optical potential of the interaction of an electron with an atom in dense semiclassical plasma of noble gases. This potential takes into account the collective screening effect and the quantum mechanical effect of diffraction. The influence of diffraction and screening effects on the characteristics of electron-atom collisions was investigated. Scattering phase shifts decrease with increase of the de Broglie wave. The electron-atom momentum-transfer cross-section at Formula Presented tends to the data obtained earlier with a neglecting of the diffraction effect. | Dzhumagulova, Karlygash N.; Shalenov, Erik O. Tashkenbayev, Yerkhan A.; Ramazanov, Tlekkabyl S. *Journal of Plasma Physics*Том 88, Выпуск 11 February 2022 Номер статьи 905880119 Scopus - сведения о документе - Study of the electron-atom collisions in dense semiclassical plasma of noble gases |
| 85. | The Effect of Non-Thermal Atmospheric | DOI 10.1109/TPS.2022.31 45831 | This contribution presents the results of a study of the germination rate and growth parameters of wheat seeds after atmospheric pressure surface coplanar dielectric barrier | Ussenov Y.A.; Akildinova, Ainur; Kuanbaevich, Bissenbaev Amangeldy; |

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| | Pressure Plasma Treatment of Wheat Seeds on Germination Parameters and α-Amylase Enzyme Activity | | discharge (DBD) plasma treatment. The germination rate and biometric parameters such as the root, shoot length, mass of the seedlings, and the α -amylase enzyme activity were studied at different plasma exposure time. The seed coat surface wettability and morphology were determined by apparent contact angle measurement and scanning electron microscope (SEM) analysis. Seed surface disinfection and the presence of filamentous fungi have also been investigated at different discharge parameters. It is shown that the optimal plasma treatment duration for increasing the growth parameters and enhancing the enzymatic activity is 5-15 s. It was found that the longer plasma exposure requires complete sterilization of the seed surface from pathogens, compared to the optimal treatment time for high germination. Based on the obtained results, the possible mechanisms of the positive effect of plasma treatment on the enhanced germination of wheat seeds are discussed. | Serikovna, Kistaubayeva Aida; Gabdullin, Maratbek; Dosbolayev, Merlan; Daniyarov, Talgat;Ramazanov, Tlekkabul *IEEE Transactions on Plasma Science*Том 50, Выпуск 2, Страницы 330 - 3401 February 2022 Scopus - сведения о документе - The Effect of Non-Thermal Atmospheric Pressure Plasma Treatment of Wheat Seeds on Germination Parameters and α-Amylase Enzyme Activity |
| 86. | Electron-atom interactions in dense semiclassical helium plasma | DOI 10.1063/5.0073657 | The effective optical potential of the electron-atom interaction in dense semiclassical helium plasma is derived. The Hartree-Fock, polarization, and exchange potentials consider the collective screening effect and the quantum-mechanical effect of diffraction. It was shown that when three components of the optical potential act together the characteristics of electron-helium scattering change significantly in comparison with results based on their separate involvement. The influence of the quantum-mechanical effect of diffraction was also discussed. | Dzhumagulova K.N.; Shalenov E.O.; Tashkenbayev Y.A.; Ramazanov T.S. *Physics of Plasmas*Том 29, Выпуск 11 January 2022 Номер статьи 012101 Scopus - сведения о документе - Electron-atom interactions in dense semiclassical helium plasma |
| 87. | Collective phenomena in a quasi-classical electron fluid within | EPL, 140 (2022) 11001. DOI-https://doi.org/10.1209/0295-5075/ac9156 | Collective processes in a quasi-classical electron gas are investigated within the frame-work of the interpolational self-consistent method of moments, which makes it possible to express | Syzganbayeva S., Ara J., Askaruly A., Ashikbayeva A. Tkachenko I. Arkhipov Y. Collective phenomena in a |

| | | | the dispersion and decrement of plasma waves, and the dynamic structural factor of the system exclusively in terms of its static structural factor so that five sum rules are satisfied automatically. Different models are used of the static structure factor; the stability and robustness of the results of the moment approach taking into account the accuracy of these models is confirmed and tested by comparison to the alternative molecular dynamics simulation data. | quasi-classical electron fluid within the interpolational self-consistent method of moments // EPL, 140 (2022) 11001. DOI-https://doi.org/10.1209/0295-5075/ac9156 |
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| | the interpolational self-consistent method of moments | | | |
| 88. | Noise Immunity of Devices of Automated Systems for Technological Control of Energy Facilities in the Almaty Region | 10.1007/978-3-030-87675-3_17 | The article presents the results of a study of the noise immunity of devices and elements of automated systems for technological control of energy facilities, associated with the use of relay cables. The analysis of the data obtained in this study is based on theoretical research methods, and the computational and experimental method were applied to determine the level of pulsed electromagnetic interference at 220 kV Taldykurgan, Stroitelnaya (Construction), Sary-Ozek, Zavodskaya and SS-220 "Shu" substations. All energy facilities considered in this article are located in the Almaty region. The influence of shielding cables on the level of electromagnetic influences on devices and elements of the automation system is revealed. It has been experimentally established that impulse noise in some relay circuits exceeds the permissible values during short-circuit and switching in the electrical network. The actual screening factors of control cables in operational conditions are determined. © 2022, The Author(s), under exclusive license to Springer Nature Switzerland AG. | Kangozhin B.R.; Baimuratov O.A.; Zharmagambetova M.S.; Dautov S.S.; Kangozhin D.B. Springer Science and Business Media Deutschland GmbH. Studies in Systems, Decision and Control Том 399, Страницы 277 – 290 2022 |
| 89. | Fabrication of Flexible Quasi-Interdigitated Back- | https://doi.org/10.3390/en15093056 | Perovskites are a promising class of semiconductor materials, which are being studied intensively for their applications in emerging new flexible optoelectronic devices. In this paper, device manufacturing and characterization of quasi- | Parkhomenko H.P., Umatova Z., Dzhumagulova K.N., |

| | | | interdigitated back-contact perovskite solar cells fabricated on flexible substrates are studied. The photovoltaic parameters of the prepared flexible quasi-interdigitated back-contact perovskite solar cells (FQIBC PSCs) are obtained for the front-and rear-side illumination options. The dependences of the device's open-circuit potential and short-circuit current on the illumination intensity are investigated to determine the main recombination pathways in the devices. Spectral response analysis of the devices demonstrates that the optical transmission losses can be minimized when FQIBC PSCs are illuminated from the front-side. Optoelectronic simulations are used to rationalize the experimental results. It is determined that the obtained FQIBC PSCs have high surface recombination losses, which hinder the device performance. The findings demonstrate a process for the fabrication of flexible back-contact PSCs and provide some directions for device performance improvements. | Jumabekov A.N. // Energies. – 2022. –Vol. 15(9). – P. 3056. |
| 90. | Passivation of perovskite layer surface states with pyridine in flexible and printed perovskite solar cells | https://doi.org/10.1088/2058-8585/ac8753 | Perovskite solar cells (PSCs), prepared by using solution-processed printing techniques, gained much attention over the past few years and a considerable progress has been achieved in improving the power conversion efficiencies of these devices. Nevertheless, there are still some advancements that can be implemented, especially in terms of passivation of surface defects in the perovskite photoactive layer. Passivation can afford considerable reduction in surface recombination of charge carriers in the photoactive layer and help to obtain devices with better performance. In this work, poly(3-hexylthiophene-2,5-diyl)-based inks with small amount of pyridine as an additive are used to deposit the hole transport layer and simultaneously passivate the surface defects of the perovskite layer in flexible and printed PSCs. The devices are fabricated on flexible conductive plastic substrates using a slot-die coating method. It is found that 2.5 | Kakimov A.G., Yerlanuly Y., Akhanuly A., Dossayev I.T., Sadirkhanov Z.T., Dzhumagulova K.N., Ng A., Jumabekov A.N. // Flexible and Printed Electronics. – 2022. –Vol. 7(3). – P. 035012. |

| | | | wt.% pyridine-containing inks for preparing hole transport layer have a positive effect on the performance of resulting PSCs. On average, around 13% improvement in the power conversion efficiency is observed for the devices with passivation as opposed to the reference devices without passivation. The effect of pyridine passivation on the structural and electronic properties of the perovskite layer on a flexible substrate is studied using experimental and analytical techniques, whereas the computer simulation methods are employed to rule out the possible mechanisms for the performance improvements in the devices with passivation. The approach presented here can be useful for developing simplified protocols for printing of flexible PSCs with the passivated perovskite layer and improved device efficiency. | |
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| 91. | Bound states of the hydrogen atom in high-density plasmas | https://doi.org/10.1002/ctpp.202200017 | In this work, the interaction potential of dense plasma particles, which takes into account the effect of quantum non-locality as well as electronic correlations, was used to solve the Schrödinger equation for the hydrogen atom. Energies of bound states were calculated. The results obtained are in good agreement with the results of other authors. | Nuraly A.T., Dzhumagulova K.N. // Contributions to Plasma Physics. – 2022. – P. e202200017. |
| 92. | Performance evaluation of different designs of back-contact perovskite solar cells | https://doi.org/10.1016/j.solmat.2021.111426 | Back-contact design for the architecture of devices is a promising approach to develop high-performance perovskite solar cells. Here, numerical simulation methods are used to investigate device properties of back-contact perovskite solar cells (BC–PSCs) with the quasi-interdigitated, flat-interdigitated, and interdigitated electrode designs. The results highlight the principal differences in the designs of the electrodes and provide an investigation and analysis of the impact of these electrodes on the photovoltaic properties of their BC-PSCs. The effect of the perovskite photoactive layer electronic properties on the performance of BC-PSCs is also investigated. It is revealed that while BC-PSCs with the quasi- | Seitkozhanov Y.S., Valagiannopoulos C., Ng A., Dzhumagulova K.N., Jumabekov A.N. // Solar Energy Materials and Solar Cells. – 2022. –Vol. 234. – P. 111426. |

| | | | interdigitated electrode design can potentially produce power conversion efficiencies (PCEs) well above 25 %, BC-PSCs with the flat-interdigitated and interdigitated electrode designs are more tolerant to electronic imperfections in the perovskite layer and can produce PCEs higher than those in devices with the quasi-interdigitated electrode design. Manufacturing and prospective use of electrodes with the quasi-interdigitated, flat-interdigitated, and interdigitated designs in developing BC-PSCs are discussed from the experimental standpoint. | |
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| 93. | On the survival of dust grains in the sublimation zone of cold white dwarfs | https://doi.org/10.1093/mnras/stac1405 | We consider a mechanism for the deposition of dust grains on to the surface of cold white dwarfs (WDs). Calculations show that grains can fall on to a cold WD directly, without reaching the phase of complete evaporation, if the parent bodies and the grains orbit on elongated, close to parabolic, orbits. To this end, we calculated the dynamics of evaporating silicate and graphite dust grains moving in circular and parabolic orbits around the white dwarf WD J1644−0449 with Teff ≈ 3830 K and M⋆ = 0.45 M☉. The calculations accounted for the influence of radiation pressure and Poynting–Robertson drag on the grain dynamics. The results show that silicate grains of all sizes considered that leave the parent bodies on circular orbits evaporate completely at a distance of ∼3 stellar radii (R⋆) from the star. The boundary of the dust-free zone for graphite grains is closer to the star, ∼1.5R⋆, and is represented confidently only for larger grains with radius > 0.5 ${\mu m}$. We determined the lower limits of the radius for grains capable of reaching the stellar surface. For comparison, we analysed the dependences of lower size limits for infalling silicate grains for a set of WDs within the temperature range 3000–5000 K. We conclude that silicate grains with an initial size ≥ 300 ${\mu m}$ can reach the surface of WD J1644−0449. For stars with temperatures in the range 3000–5000 K, the corresponding grain size range is 0.016 μm–5 cm. | Lyubov I Shestakova, Akmaral I Kenzhebekova, Aleksander V Serebryanskiy, On survival of dust grains in the sublimation zone of cold white dwarfs, *Monthly Notices of the Royal Astronomical Society*, Volume 514, Issue 1, July 2022, Pages 997–1005, https://doi.org/10.1093/mnras/stac1405 |

| 94. | Coulomb logarithm and the Dreicer field in a dense semiclassical plasma | https://doi.org/10.1002/ctpp.202200014 | We obtained an expression for the Coulomb logarithm for a dense semiclassical plasma based on momentum transport cross sections using an effective interaction potential. It was shown that for densities and temperatures corresponding to the dense semiclassical plasma our results are in good agreement with MD simulations. We applied the Coulomb logarithm for the calculation of the Dreicer field. The case of dense non-thermal Lorentzian semiclassical plasma was considered, too. | Seisembayeva M.M., Reinholz H., Jumagulov M.N., Dzhumagulova K.N. // Contributions to Plasma Physics. – 2022. – P. e202200014. |
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| 95. | Study of bound and resonance states of 11Be in breakup reaction | 10.32523/ejpfm.2022060301 | We investigate the Coulomb breakup of the $^{11}$Be halo nuclei on a lead target within non-perturbative time-dependent approach in a wide range of beam energy (5–70 MeV/nucleon) including the low-lying resonances in different partial and spin states of $^{11}$Be. We have found considerable contribution of the low-lying resonances ( $5/2^+$, $3/2^-$ and $3/2^+$ ) to the breakup cross section of $^{11}$ Be. The obtained results are in good agreement with existing experimental data at 69 MeV/nucleon. The developed computational scheme opens new possibilities in investigation of Coulomb, as well as nuclear, breakup of other halo nuclei on heavy, as well as, light targets. © 2022, Eurasian Journal of Physics and Functional Materials. All Rights Reserved. | Valiolda, D.S., Janseitov, D.M., Melezhik, V.S., Study of bound and resonance states of 11Be in breakup reaction, Eurasian Journal of Physics and Functional Materials, Volume 6, Issue 3, Pages 165 – 173, 10.32523/ejpfm.2022060301 |
| 96. | Study of Nuclear Contribution to Breakup Cross Section of 11Be Halo Nuclei within Time-Dependent Approach | 10.1134/S15474771122050442 | Abstract: In this work, the influence of nuclear interaction to the Coulomb breakup of one-neutron halo nuclei on a heavy target has been studied within the non-perturbative time-dependent approach for low beam energies (5–30 MeV/nucleon) including the low-lying resonances in different partial and spin states of 11$^{Be}$. Overall, this numerical technique allows an accurate and straightforward modeling of the nuclear interaction between the projectile and the target on a widely range of the beam energies. Our calculations can be potentially useful for exploring the halo structure | Valiolda, D.S., Janseitov, D.M., Melezhik, V.S., Study of Nuclear Contribution to Breakup Cross Section of 11Be Halo Nuclei within Time-Dependent Approach, Physics of Particles and Nuclei Letters, Volume 19, Issue 5, Pages 477 – 480 October 2022, 10.1134/S1547477122050442. |

| | | | in breakup reactions with low beam energies. © 2022, Pleiades Publishing, Ltd. | |
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| 97. | QCD Effects in Non-QCD Theories | 10.1007/s10701-022-00642-1 | It is shown that, in some non-QCD theories, there are effects shared by QCD: (i) in SU(2) Yang–Mills theory containing a nonlinear spinor field, there is a mass gap; (ii) in SU(3) Proca–Higgs theory, there are flux tube solutions with a longitudinal electric field required for producing a force binding quarks; (iii) in non-Abelian Proca–Higgs theories, there exist flux tube solutions with a momentum directed along the tube axis and particlelike solutions with a nonvanishing total angular momentum created by crossed color electric and magnetic fields; in QCD, such configurations may contribute to the proton spin. We discuss the conjecture that such non-QCD theories might be a consequence of approximate solution of an infinite set of Dyson–Schwinger equations describing the procedure of nonperturbative quantization. The phenomenon of dimensional transmutation for nonperturbative quantization and the analogy between nonperturbative quantization and turbulence modeling are also discussed. © 2022, The Author(s), under exclusive licence to Springer Science+Business Media, LLC, part of Springer Nature. | Dzhunushaliev, V., Folomeev, V., QCD Effects in Non-QCD Theories, Foundations of Physics, Volume 52, Issue 6December 2022 Article number 118, 10.1007/s10701-022-00642-1. |
| 98. | Irradiation capsule design for neutron coloration of topaz in a WWR-K reactor | 10.1016/j.apradiso.2022.110472 | This study justifies irradiation capsule design calculations used for efficient coloring of topaz in a WWR-K reactor. Various radiation screens used for removing thermal and epithermal neutrons and their influence on the activation of the main impurities in topaz are considered. Neutron analysis has been performed by means MCNP transport code. It is shown that the use of a sandwich screen composed of boron carbide and tantalum decreases the fraction of thermal neutrons by 24% and increases the fraction of fast neutrons by 15%. These are the optimal neutron conditions for topaz irradiation in a WWR-K reactor. Thermal analysis | Akhanov A.M., Aitkulov M.T., Sairanbayev D.S., Gizatulin, Sh.Kh., Romanova N.K., Shaimerdenov A.A., Chikhray Y.V., Ualzhanov, Zh., Zholdybayev T.K., Irradiation capsule design for neutron coloration of topaz in a WWR-K reactor, Applied Radiation and Isotopes, Volume 190December 2022 Article |

| | | | has been performed by means Comsol code and two approaches were taken: conservative and realistic. A thermo-physical analysis with a conservative approach showed that for boron carbide and tantalum screen the temperatures under forced and natural convection modes were 134°C and 274°C, respectively. The temperature of the case body was 75 °C with forced cooling and 238 °C without cooling. In case of realistic approach, the topaz temperature does not exceed 65°C if regular cooling of the irradiation capsule is ensured. Calculation results showed the importance of the ensure circulation between topaz during irradiation, which makes it possible to reduce the temperature of topaz by almost half. | number 110472, 10.1016/j.apradiso.2022.110472 |
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| 99. | Analysis of the reactor experiments results on the study of gas evolution from two-phase Li2TiO3-Li4SiO4 lithium ceramics | 10.1016/j.nme.2022.101132 | This paper analyzes part of the reactor experiments on the study of tritium and helium release from promising two-phase lithium ceramic ($Li_2TiO_3$ and $Li_4SiO_4$) of natural lithium enrichment conducted by vacuum extraction. The basis for such an analysis was a more careful study of the time trend of pressure changes of gases in the chamber with the test samples. In a particular case, it was clearly shown that the pressure fluctuations observed during irradiation for gases with mass number M4 (to which both HT and He molecules correspond) are determined only by He, which leaves the intergranular regions of the ceramic through open channels or cracks. The kinetics of changes in the amount of helium that is released during irradiation was traced and both the rate of helium release and the frequency of emissions were determined. It was assumed that the observed emissions correspond to a certain "formation of free paths" from the internal cavities of the irradiated ceramics into the chamber of the facility. The data obtained for the helium emissions were compared with the release of tritium-containing molecules from the ceramics. The quasi-equilibrium levels of the release of tritium-containing molecules and their dependence on | Kenzhina, I., Kulsartov, T., Knitter, R., Chikhray Yevgen, Tolenova, A., Nesterov, E., Analysis of the reactor experiments results on the study of gas evolution from two-phase Li2TiO3-Li4SiO4 lithium ceramics, Nuclear Materials and Energy, Volume 30March 2022 Article number 101132, 10.1016/j.nme.2022.101132 |

| | | | the reactor power were estimated. The release of helium and tritium was compared with the calculated values of the tritium generation rate in the test sample. | |
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| 100. | Studies of two-phase lithium ceramics Li4SiO4-Li2TiO3 under conditions of neutron irradiation | 10.1016/j.nme.2022.101129 | This work presents the preliminary experimental data on the study of gas release from two-phase lithium ceramics $Li_4SiO_4$-$Li_2TiO_3$ under neutron irradiation conditions. Experiments were carried out at the WWR-K research reactor (Almaty, Kazakhstan) for ~4.3 days. The total neutron fluence during the irradiation was ~$1.8 \cdot 10^{19}$n/cm$^2$. In the course of irradiation, two experiments on ceramics heating during irradiation and two experiments with hydrogen isotopes ($H_2$ and $D_2$) supply into the experimental chamber with the sample were performed at a temperature of 680 °C and reactor power of 6 MW. During the entire irradiation, the gas composition in the continuously evacuated ampoule device with samples was recorded. The obtained dependences of the release of tritium-containing molecules and helium during the experiment were qualitatively analyzed. | Kulsartov, T., Zaurbekova, Z., Knitter, R., Chikhray, Y., Gordienko, Y., Ponkratov, Y., Studies of two-phase lithium ceramics Li4SiO4-Li2TiO3 under conditions of neutron irradiation, Nuclear Materials and Energy, Volume 30March 2022 Article number 101129, 10.1016/j.nme.2022.101129 |
| 101. | Investigation of hydrogen and deuterium impact on the release of tritium from two-phase lithium ceramics under reactor irradiation | 10.1016/j.nme.2022.101115 | In the development of fusion energy, an important task is the study and improvement of tritium production technologies. In this case, one of the most promising materials for tritium generation is lithium ceramics. Considering the importance of the task, numerous studies are aimed at solving the problem of determining the parameters and mechanisms of tritium release in lithium-containing materials. This paper presents the results of a study of tritium release processes from two-phase lithium ceramics of $Li_4SiO_4$/$Li_2TiO_3$ during reactor irradiation when hydrogen and deuterium are injected into the chamber with irradiated samples. The mechanisms regularities of the tritium yield process in the presence of these isotopes were established. The experiments were carried out in the WWR-K | Kulsartov, T., Kenzhin, Y., Knitter, R., Chikhray, Y., Gordienko, Y., Ponkratov, Y., Investigation of hydrogen and deuterium impact on the release of tritium from two-phase lithium ceramics under reactor irradiation, Nuclear Materials and Energy, Volume 30March 2022 Article number 101115, 10.1016/j.nme.2022.101115 |

| | | | research reactor at a neutron flux density of $5 \cdot 10^{13} \text{n/cm}^2 \cdot \text{s}$ and sample temperatures from 650 to 700 °C. | |
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| 102. | Analysis of reactor experiments to study the transfer processes of generated tritium in lithium cps (capillary-porous system) | 10.1016/j.ijhydene.2021.03.163 | To date, there have been many studies on the possibility of using lithium CPS as a plasma-facing material in fusion reactors. For use such liquid-lithium systems in fusion reactors, it is necessary to determine the interaction parameters of the surface facing the plasma with the working gases under conditions simulating the real operation of the facility, i.e. under conditions of neutron and gamma radiation. Therefore, this paper is devoted to the study of the processes of hydrogen isotopes interaction with lithium CPS under reactor irradiation. The experiments presented in work were carried out at the IVG1.M research reactor by using dynamic sorption method with the presence of deuterium under the lithium CPS sample. The results of reactor experiments simulation, in particular, the distribution of tritium concentration in lithium volume and traps, and the flows of tritium released through the inner surface of the CPS into the experimental chamber at different temperatures are presented. Based on the simulation results, the following interaction parameters of tritium with lithium were determined: temperature dependences of tritium capture constant by lithium and the dissociation constant of LiT. The obtained model can be applied for analysis of tritium generation and release from different lithium-containing materials used as a filling of CPS structure (for example, lithium and tin-lithium eutectics). | Askerbekov, S., Kenzhina, I., Kulsartov, T.,Chikhray, Y., Kadyrzhanov, K., Nesterov, E., Analysis of reactor experiments to study the transfer processes of generated tritium in lithium cps (capillary-porous system), International Journal of Hydrogen Energy, Volume 47, Issue 11, Pages 7368 - 73785 February 2022, 10.1016/j.ijhydene.2021.03.163 |
| 103. | Optical studies of thin films of cryocondensed mixtures of water | 10.3390/ma15217441 | The interaction of host molecules with water molecules is of primary importance in astrophysical and atmospheric studies. Water-binding interactions continue to attract a broad interest in various fields, especially those related to the formation of assembly structures. Using the physical vapor deposition | Sokolov, D.Y., Yerezhep, D., Vorobyova, O., Ramos, M.A., Shinbayeva, A., Optical studies of thin films of cryocondensed mixtures of water and |

| | | | (PVD) method and a two-beam interferometer with a wavelength of 406 nm, the refractive indices of thin films of a water and nitrogen (argon) mixture were calculated in the range from 15 to 35 K. The results of temperature transformations of the obtained films from a two-beam interferometer, and thermal desorption characteristics from the temperature of condensation to the temperature of evaporation of water (15–180 K), are presented. The relationship between the signal of the interferometer, the refractive index, and the film thickness during glass transition is demonstrated. | admixture of nitrogen and argon, Materials, Volume 15, Issue 21November 2022 Article number 7441, 10.3390/ma15217441 |
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| | and admixture of nitrogen and argon | | | |
| 104. | Radiation-stimulated absorption processes on the surface of beryllium oxide | 10.15826/chimtech.2022.9.1.06 | The paper presents the study results of photo and gamma radiation effect on the beryllium oxide (BeO) surface properties. Photoadsorption studies of O2 on BeO by the methods of infrared (IR) spectroscopy and manometry with a change in the temperature of preliminary annealing from 473 to 1073 K show that samples subjected to preliminary training at 473 K are most active. The maximum of adsorption activity on γ-irradiated beryllium oxide is observed on the samples annealed at 673 K before the irradiation. The maximum of paramagnetic centers (PMCs) is also observed on samples annealed at this temperature. Comparison of electron paramagnetic resonance (EPR) and adsorption studies shows that absorption of H2 and O2 leads to the destruction of paramagnetic centers. It is assumed that, upon irradiation, adsorption centers with electron and hole modes are formed on the surface of BeO. | Tusseyev, T.T., Danlybaeva, A.K., Raimkul, S.S., Kiykabaeva, A.A., Doszhanov, O.M., Radiation-stimulated absorption processes on the surface of beryllium oxide, Chimica Techno Acta, Volume 9, Issue 12022 Article number 20229106, 10.15826/chimtech.2022.9.1.06 |
| 105. | A joint hydrogen and syngas chemical kinetic model optimized by particle swarm optimization | 10.1016/j.fuel.2022.125945 | In this work, we propose a novel data-driven framework for detailed kinetic mechanisms optimization applying the heuristic algorithm, namely canonic Particle Swarm Optimization (PSO). The PSO is more effective and robust in coping with uncertainties and incomplete information than deterministic and | Wang, H., Sun, C., Haidn, O., Askarova, A., Manfletti, C., Slavinskaya, N., A joint hydrogen and syngas chemical kinetic model optimized by particle swarm optimization, |

| | | | probabilistic optimization algorithms and is more suitable for machine learning applications. In the proposed framework, to avoid trapping in a local minimum, 1000 local optimums have been obtained and statistically handled to select the final feasible model parameter set with reduced uncertainty intervals and parameter correlations. The developed framework was successfully used for the optimization of the joint $H_2$ and syngas oxidation chemical kinetic model. The data set collected for the model optimization includes 41 reactions and 16 species, and 3000 experimental data targets supplied with uncertainty boundaries measured in shock tubes, jet stirred reactors, plug flow reactors, and premixed laminar flames under wide ranges of temperature, pressure, equivalence ratio, and $H_2/CO$ ratios. The initially estimated uncertainties of the reaction rate constants for 15 key reactions were significantly constrained. The reaction rate constants for the $H_2$ oxidation sub-model were re-optimized and their uncertainties were further reduced. | Fuel, Volume 33215 January 2023 Article number 125945, 10.1016/j.fuel.2022.125945 |
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| 106. | Simulation of concentration convection in an inclined channel | 10.1615/HeatTransRes.2022043133 | Numerical simulation of the concentration convection that occurs in a three-component gas mixture He + Ar – $N_2$ in an inclined channel has been carried out. To describe the occurrence of convective flows in the mixture under consideration, a 3D numerical algorithm based on the D3Q19 model of the Boltzmann lattice equation method has been developed. It is shown that when the slope angle changes in the range from 40° to 80°, the isoconcentration lines are curved, which indicates the presence of convective mechanisms in the total mass transfer. It is shown that at an inclination angle of 60°, the intensity of convective transfer is maximum. | Zhakebayev, D., Fedorenko, O., Kossov, V., Zhumali, A., Mukamedenkyzy, V., Karuna, O., Simulation of concentration convection in an inclined channel, Heat Transfer Research, Volume 53, Issue 15, Pages 39 – 522022, 10.1615/HeatTransRes.2022043133 |

| 107. | Open Lesson as a Means of Teachers' Learning | 10.3390/educsci1210 0692 | Open lesson (OL), similar to the Japanese lesson study in many aspects, is a professional development model regularly used in schools in the Commonwealth of Independent States Countries. The purpose of this study was to examine teachers' and students' attitudes and beliefs about OL practices and activities, using both quantitative and qualitative methods. The sample consisted of 72 instructors and 239 university students in Kazakhstan. MANOVA results from teacher data and student data indicated weak positive attitudes and beliefs about OL. Moreover, no differences were found between the gender, discipline, nationality, and teaching experience of teachers, while students learning social sciences showed stronger positive attitudes and beliefs about the effect of OL on learning when compared to students learning natural sciences. Slightly positive attitudes and beliefs of participants imply that OL implementations in schools should be reconsidered. | Japashov N.M, Abdulbakioglu, M., Kolushpayeva, A., Balta, N., Bae, C.L., Open Lesson as a Means of Teachers' Learning, Education Sciences, Volume 12, Issue 10October 2022 Article number 692, 10.3390/educsci12100692 |
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| 108. | Middle- and secondary-school students' STEM career interest and its relationship to gender, grades, and family size in Kazakhstan | 10.1002/sce.21776 | Despite pervasive educational efforts, student interest in STEM careers continues to decline in many countries. The present study seeks to better understand this phenomenon by examining how internal factors (gender) and external factors (school grades, grade level, family size) relate to Kazakh students' STEM career interests. To this end, a newly developed instrument (STEM Career Interest Survey) based on social cognitive career theory was used to assess interest in STEM careers among middle- and secondary students in Kazakhstan. The survey was completed by a sample of 396 Kazakh students in grades 7 to 12. Our statistical analyses revealed that (1) female students were generally less interested in STEM careers than male students; (2) students with higher grades in physics classes were | Japashov N.M, Balta, N., Mansurova, A., Oliveira, A.W., Lathrop, R., Middle- and secondary-school students' STEM career interest and its relationship to gender, grades, and family size in Kazakhstan, Science Education, 10.1002/sce.21776 |

| | | | significantly more interested in STEM careers than low-performing students; (3) students at higher grade levels were generally more interested in STEM careers than those in lower grade levels; (4) the number of siblings was positively associated with student interest in mathematics careers; and, (5) family support and role models were significantly correlated with student STEM career interest. Our findings suggest that student development of interest in STEM careers constitutes an epigenetic phenomenon that involves complex interactions between internal factors (e.g., self-efficacy) and external factors (e.g., gender stereotypes). Based on this, it is argued that the promotion of student interest in STEM careers is a multifaceted problem whose resolution requires, among other things, dispelling stereotypes in students' sociocultural context through systematic renegotiation of traditional gender-technology relations characteristic of a country's culture. | |
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| 109. | Efficient Recovery Annealing of the Pseudocapacitive Electrode with a High Loading of Cobalt Oxide Nanoparticles for Hybrid Supercapacitor Applications | 10.3390/nano12203669 | Electrochemical pseudocapacitors, along with batteries, are the essential components of today's highly efficient energy storage systems. Cobalt oxide is widely developing for hybrid supercapacitor pseudocapacitance electrode applications due to its wide range of redox reactions, high theoretical capacitance, low cost, and presence of electrical conductivity. In this work, a recovery annealing approach is proposed to modify the electrochemical properties of $Co_3O_4$ pseudocapacitive electrodes. Cyclic voltammetry measurements indicate a predominance of surface-controlled redox reactions as a result of recovery annealing. X-ray diffraction, Raman spectra, and XPES results showed that due to the small size of cobalt oxide particles, low-temperature recovery causes the transformation of the $Co_3O_4$ nanocrystalline phase into the CoO phase. For the same reason, a rapid reverse transformation of CoO into | Abdullin, K.A., Gabdullin, M.T., Kalkozova, Z.K., Nurbolat, S.T., Mirzaeian, M., Efficient Recovery Annealing of the Pseudocapacitive Electrode with a High Loading of Cobalt Oxide Nanoparticles for Hybrid Supercapacitor Applications, Nanomaterials, Volume 12, Issue 20October 2022 Article number 3669, 10.3390/nano12203669 |

| | | | $Co_3O_4$ occurs during in situ oxidation. This recrystallization enhances the electrochemical activity of the surface of nanoparticles, where a high concentration of oxygen vacancies is observed in the resulting $Co_3O_4$ phase. Thus, a simple method of modifying nanocrystalline $Co_3O_4$ electrodes provides much-improved pseudocapacitance characteristics. | |
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| 110. | Synthesis and Microwave Absorption Properties of Ni0.5Zn0.5Fe2O4/CI Composite Coated with Polyaniline within Paraffin Wax Matrix | 10.31489/2022Ch3/3-22-8 | Ternary composites of polyaniline/$Ni_{0.5}Zn_{0.5}Fe_2O_4$/carbonyl iron (PANI/F/CI) are prepared via two stages. Firstly, $Ni_{0.5}Zn_{0.5}Fe_2O_4$ is prepared using a sol-gel method. After that, PANI/F/CI composites are prepared using an in-situ polymerization technique of PANI in the existence of the $Ni_{0.5}Zn_{0.5}Fe_2O_4$ and CI. X-ray diffractometry (XRD), Fourier transform infrared (FTIR) spectroscopy, Ultraviolet-visible (UV-vis) spectroscopy, and Thermogravimetric analysis (TGA) are utilized to characterize samples. The morphology of the powders is investigated by Scanning electron microscope (SEM). The electromagnetic interference (EMI) shielding and microwave absorption (MA) properties are measured in the frequency band of 8.8–12 GHz to investigate the microwave characterization. The results refer those microwave absorption properties are related to the absorber thickness and the loading ratio of the absorber within a paraffin matrix. Minimal reflection loss of –30.8 dB at the matching frequency ($f_m$) of 10.3 GHz and the absorption bandwidth under –10 dB ($BW_{-10dB}$) of 2.8 GHz for 3.4 mm thickness with a surface density (SD) of 3.38 kg/m$^2$ are noticed for the PANI/F/CI composite sample. The maximum shielding efficiency (SE) of 30.12 dB at 11.0 GHz for 3.2 mm thickness is observed for the PANI/F/CI composite sample. | Meirambekuly, N., Temirbayev, A.A., Zhanabaev, Z.Z., Khaniyev, B.A., Khaniyeva, A.K., Synthesis and Microwave Absorption Properties of Ni0.5Zn0.5Fe2O4/CI Composite Coated with Polyaniline within Paraffin Wax Matrix, Bulletin of the Karaganda University Chemistry Series, Volume 107, Issue 3, Pages 254 – 266, 10.31489/2022Ch3/3-22-8 |

| 111. | Growth and Liquid-Phase Exfoliation of GaSe1−xSx Crystals | 10.3390/ma15207080 | In recent years, interest in the liquid-phase exfoliation (LPE) of layered crystals has been growing due to the efficiency and scalability of the method, as well as the wide range of practical applications of the obtained dispersions based on two-dimensional flakes. In this paper, we present a comparative study of as-grown and liquid-phase exfoliated $GaSe_{1-x}S_x$ flakes. Bulk $GaSe_{1-x}S_x$ crystals with x ~ 0, 0.25, 0.5, 0.75, 1 were synthesized by melting stoichiometric amounts of gallium, selenium, and sulfur particles in evacuated ampoules. X-ray diffraction analysis showed that the crystal structure does not change considerably after LPE, while the analysis of the Raman spectra revealed that, after liquid-phase processing in IPA, an additional peak associated with amorphous selenium is observed in selenium-rich GaSeS compounds. Nevertheless, the direct and indirect transition energies determined from the Kubelka-Munk function for LPE crystals correlate with the band gap of the as-grown bulk GaSeS crystals. This finding is also confirmed by comparison with the data on the positions of the photoluminescence peak. | Aitzhanov, M., Guseinov, N., Nemkayeva, R., Prikhodko, O., Mukhametkarimov, Y., Growth and Liquid-Phase Exfoliation of GaSe1−xSx Crystals, Materials, Volume 15, Issue 20October 2022 Article number 7080, 10.3390/ma15207080 |
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| 112. | Preparation and characterization of hybrid nanopowder based on nanosilicon decorated with carbon nanostructures | 10.1007/s13204-022-02681-6 | Hybrid nanopowder based on silicon nanoparticles (Si NPs) decorated with carbon NPs was prepared by high-temperature treatment of the oxidized surface of porous Si NPs impregnated with a carbonaceous precursor. The Si NPs decorated by carbon NPs and carbon nanostructures (CNs) were studied with TEM. The surface chemistry for hybrid NPs was characterized by the TPD MS method, and carboxyl, lactone, and phenol groups were found. The CNs and carbon NPs influence the electric response of a sandwich structure that was prepared using the hybrid NPs modified with palladium NPs and then was tested to measure the concentration of hydrogen in nitrogen-hydrogen gas mixtures. The sandwich structure | Mussabek, G., Zhylkybayeva, N., Baktygerey, S., Zaderko, A.N., Lisnyak, V.V., Preparation and characterization of hybrid nanopowder based on nanosilicon decorated with carbon nanostructures, Applied Nanoscience (Switzerland), 10.1007/s13204-022-02681-6 |

| | | | showed reasonable stability of the electrical response, presumably due to the formation of a specific sensitive layer. | |
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| 113. | Influence of Si atoms on the structure and electronic properties of amorphous DLC films | 10.1016/j.jnoncrysol. 2022.121956 | The paper considers the effect of silicon on the formation of the structure and properties of amorphous diamond-like carbon (DLC) films. Thin films of silicon-modified amorphous diamond-like carbon (DLC:Si) were synthesized by magnetron ion-plasma co-sputtering of a combined target. Studies of the structure and properties of amorphous DLC:Si films were carried out in the range of silicon concentrations up to 6.75 at.%. A change in the formation of the film structure is shown using atomic force microscopy (AFM) and transmission electron microscopy (TEM). Raman spectroscopy (RS) and X-ray photoelectron spectroscopy (XPS) revealed a significant change in the local structure of amorphous DLC:Si films. Which, in turn, leads to a change in the density of states of $\pi$-electrons in the band and, as a rule, to a change in the electronic properties. | Ryaguzov, A., Kudabayeva, M., Myrzabekova, M., Nemkayeva, R., Guseinov, N., Influence of Si atoms on the structure and electronic properties of amorphous DLC films, Journal of Non-Crystalline Solids, Volume 5991 January 2023 Article number 121956, 10.1016/j.jnoncrysol.2022.1219 56 |
| 114. | Perovskite-Based Solar Cells: Some Problems and Ways of their Solution | 10.18321/ectj1436 | The fundamental aspects of the perovskite absorber formation of solar irradiation for two generally accepted one-and two-step technologies are considered. For the on-step variant, two stages of perovskite formation, called "through solution" and "intermediate colloid compounds of precursors", were identified. The successive deposition of precursors is described in terms of thermodynamics and the Ostwald ripening model. The optimal conditions for the concentration and temperature for the spinning solution of methylammonium iodide to obtain various sizes of perovskite crystallites are presented. Examples are given for some other approaches that are used in the formation of high-quality perovskite films with high optoelectronic characteristics for a conversion rate of perovskite based solar cells on them. | Ashurov, N., Oksengendler, B., Maksimov, S., Yar-Mukhamedova, G., Zhamanbayeva, G., Perovskite-Based Solar Cells: Some Problems and Ways of their Solution, Eurasian Chemico-Technological Journal, Volume 24, Issue 3, Pages 229 - 23910 October 2022, 10.18321/ectj1436 |