constants cause a stronger shift of the extinction peak toward longer wavelengths and an increase in extinction values at the operating wavelength. Additionally, the orientation of the external electric field relative to the substrate also affects the magnitude of these changes. It is shown that increasing the size of nanoparticles has almost no effect on the position of the extinction peak, but significantly increases the maximum values of the extinction cross-section. It was also established that changing the distance between nanoparticles and the substrate leads to a shift in extinction spectra, especially for substrates with higher dielectric constants.

These results provide important knowledge for the design and optimization of plasmonic structures in optoelectronics. A better understanding of the interaction between nanoparticles and substrates allows predicting the optical properties of systems and creating specialized optical structures with improved characteristics. Overall, the study emphasizes the importance of proper selection of substrate material and consideration of interaction at the nanoparticle-substrate interface when designing effective plasmonic systems for modern optical devices and sensors.

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Some problems of modelling the critical processes in astrophysics of white dwarfs

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Main peculiarities of formulation main principles and criteria of white dwarf theories are analyzed. Short comparative analysis of main methods of modeling is represented [1 – 6]. All thes methods must be based on the conditions of equilibrium. It is shown that Stoner method [5], Lane-Emden equations [2] and Einstein equations [3] is based on the search of equilbrium conditions for sphere or sample to sphere symmetries. Main peculiarities of Stoner method and Lane-Emden equtions are observed. Peculiarities of application methods of general relarivityy for modelling white dwarf structure and processes are analyzed too.

Main concepts of theory of white dwarfs are discussing [6]. The role of A. Eddington, R. Fowler, E. Stoner and S. Chandrasekar ([2, 5, 6] researches in the creation this theory is discussed. The role of the development of theoretical physics (Fermi-Dirac statistics) in the creation of this theory is shown [5].

It should be noted that thanks to Stoner's research [5], the Pauli principle and one of the first applications of Fermi-Dirac statistics for degenerate electronic systems appeared in the Bohr theory of the atom precisely in the theory of white dwarfs.

A. Eddington, R. Fowler, their student S. Chandrasekhar, E. Stoner, V. Anderson and others made the main contribution to the development of the theory of white dwarfs [5, 6].

A. Eddington initiated the study of white dwarfs and, in addition, pointed out that the source of the stars' energy is thermonuclear reactions of hydrogen and helium synthesis (Eddington, 1926). He also proposed to use the Lane-Emden equations to construct the theory of white dwarfs, which allow us to describe processes in polytropic gas spheres. This method for white dwarfs was developed by A. Fowler, and most of all by S. Chandrasekhar [5, 6]

R. Fowler was the first to draw attention to the use of Fermi-Dirac statistics for the theory of white dwarfs [5]. However, the first theory for former dwarfs was built by E. Stoner [5]. At the heart of his theory he put the variational principle, which he used for total energy. Vio estimated the density and mass of the white dwarf. This same method was used by S. Chandrasekhar to determine the density of a white dwarf. He built a more complete theory of a gray dwarf based on the Lane-Emden equations [2].

It should be noted that all astrophysical models are built based on considerations of equilibrium, and are still tied in one way or another to spherical symmetry. Thus, the Lane-Emden equations are derived for the equilibrium conditions of a gas sphere taking into account the corresponding polytropic process. Chandrasekhar separately derived this equation for isothermal case too [2]. However, these equations do not take into account the rotation of the star [6]. Einstein's equation is nothing but the equality of potential (effective) energy, which also takes into account the rotation and kinetic energy [2, 6]. That is, it is nothing but an extension of the methods of celestial mechanics. All the metrics that are in the general theory of relativity, roughly speaking, are derived from the spherical metric [3]. Therefore this metod ass more universal for astrophysical applications was recommended by A. Eddingtom [3].

In the theory of degenerate dwarfs by S. Chandrasekhar is generalized by constructing multiparameter and multiphase models that take into account the incomplete degeneracy of the electronic subsystem, the presence of interparticle interactions, magnetic fields, variable chemical content along the radius, and axial rotation of stars [6]. It is allowed to adequately describe and provide interpretation of modern observed data. Based on the solution of the equilibrium equations, the dependence of the structural and energy characteristics of dwarfs on the parameters of the models was determined. The inverse problem of the theory of degenerate dwarfs was solved – the determination of the main structural and thermodynamic parameters of the models based on data on the masses, radii, and effective temperatures of observed field dwarfs and dwarfs in binaries systems [6].

S. Chandrasekhar theory of white dwarfs was developed in second half of 20^{th} century. In the works of E. Shatsman, S. Chandrasekhar, S. Kaplan, R. James L. Mestell, I. Zeldovich, and I. Novikov, an elementary theory of cooling of degenerate dwarfs was constructed [6]. The issues of stability in relation to neutronization processes, the effects of the general theory of relativity and the influence of axial rotation, etc., were also considered. Much less attention has been paid to the generalization of models of the internal structure of dwarfs. Here it should be noted the work of E. Solpiter on the equation of state of the electron-nuclear model at high couplings with approximate consideration of Coulomb interactions (at T = 0 K) and the work of T. Hamada and E. Solpiter devoted to the calculation of the "mass-radius" ratio for homogeneous two-component models corresponding to chemical elements with a nuclear charge of $2 \leq z \leq 26$ based on the equation of state obtained by E. Solpiter and with the acceleration of neutronization processes, but taking into account the effects of the general theory of relativity [6].

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Main problems of Relaxed Optical methods of creation and modeling thin films

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The problem of using the laser radiation in technology of thin films may be classifying in next time [1, 2]:

1. Using the laser radiation for sputtering of irradiated material and applying it to a suitable substrate in a vacuum. The thickness of the applied film depends on the intensity and time of irradiation. The process itself has an orientation character [1, 2].
2. Laser implantation, that is, a change in the physical parameters of the irradiated material in the near-surface area, although volume changes can also be obtained [1, 2].
3. Other various complex treatments, including laser annealing of ion-implanted layers of semiconductor materials, photolithography, etc [1, 2].

For all these three cases, we must take into account the physical and chemical aspects of the interaction of laser radiation with matter.

Hererostructures of laser-sprayed cadmium sulfide on black silicon [1, 2] and copper sulfide also on black silicon [1, 2] were analyzed. Black silicon itself was obtained by physical and chemical methods. It is shown that the sputtering profile of these materials resembles the profile of black silicon. The problem of formation of laser-induced support centers in indium antimonite is considered [1, 2]. Based on the two-dimensional lattice of sphalerite for indium antimonide, a cascade model of the excitation of the corresponding number and type of chemical bonds was constructed, which satisfactorily explains the observed results. In addition, based on this, a model is proposed that explains the influence of reirradiation and reabsorption processes on the distribution of donor centers in indium antimonide and on the shape of their distribution profiles [1].

The formation processes of laser-induced urchin-type surface structures on silicon [] are also explained on the basis of a cascade model of excitation of the corresponding number of chemical bonds (coordination numbers) in the regime of saturation the excitation based on the phase diagram of silicon. It is shown that this process depends on the integral photon efficiency, and upon irradiation with nanosecond pulses of an excimer laser is more effective than when irradiated with femtosecond laser pulses from the near-infrared region of the spectrum.

Using the example of indium antimonide and indium arsenide, the influence of the spectral composition of optical radiation on the laser annealing of ion-implanted layers of these materials is shown [1].

The expediency of using laser radiation in lithography and production of black silicon and other similar structures is also shown [1, 2].

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