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V ХАЛЫҚАРАЛЫҚ ФАРАБИ ОҚУЛАРЫ

Алматы, Қазақстан, 3-13 сәуір, 2018 жыл

ӘБДІЛДИН ОҚУЛАРЫ: ЗАМАНАУИ ФИЗИКАНЫҢ КӨКЕЙКЕСТІ МӘСЕЛЕЛЕРІ

ҚР ҰҒА академигі Әбділдин Мейірхан Мұбарақұлының 80-жылдығына арналған атты халықаралық ғылыми конференция

МАТЕРИАЛДАРЫ

Алматы, Қазақстан, 12-15 сәуір 2018 жыл

V МЕЖДУНАРОДНЫЕ ФАРАБИЕВСКИЕ ЧТЕНИЯ

Алматы, Казахстан, 3-13 апреля 2018 года

МАТЕРИАЛЫ

международной научной конференции

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посвященной 80-летию академика НАН РК Абдильдина Мейрхан Мубараковича

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V INTERNATIONAL FARABI READINGS

Almaty, Kazakhstan, 3-13 April 2018

MATERIALS

of the International Scientific conference dedicated to the 80th anniversary of Academician of the NAS RK Abdildin Meirkhan Mubarakovich

ABDILDIN READINGS: ACTUAL PROBLEMS OF MODERN PHYSICS

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AL-FARABI KAZAKH NATIONAL UNIVERSITY

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АЗИЯ-ТЫНЫҚ МҰХИТ ТЕОРИЯЛЫҚ ФИЗИКА ОРТАЛЫҒЫ
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STATIC COLD EQUILIBRIUM WHITE DWARF RELATIVISTIC STARS WITH KNOWN NUCLEAR COMPOSITIONS

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In the present work we investigate the hydrostatic equilibrium configurations of static cold white dwarf stars in general relativity. Namely, we solve numerically the set of relativistic differential equations of stellar structure with the given initial conditions [1a]. These differential equations of stellar structure are called the Tolman-Oppenheimer-Volkoff equations [2a, b], who first derived them. But,there are three independent functions (mass, density, pressure)in the system of equations of stellar structure, whereas the number of equations is two. It is obvious that such kind of system is unclosed and cannot be solved both analytically and numerically. So, in order to solve the equations of stellar structure two of the functions in the set of differential equations should be linked together. The density and pressure of the matter is usually linked together, mostly, for the case of compact objects and it is called the equation of state of stellar matter. In our case, we employ the Salpeter (sometimes Hamada-Salpeter) equation of state [3a, b] to solve the Tolman-Oppenheimer-Volkoff equations. The Salpeter equation of state gives an opportunity to take into account the nuclear composition, neutronization threshold, the Thomas-Fermi corrections and Coulomb interactions which make theoretical results more reliable.

As a result, the main parameters of static cold white dwarfs such as mass, radius, central density and central pressure have been calculated. Furthermore, the relations of mass-radius, mass-...

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density and central pressure are plotted for the different nuclear compositions such as ^{4}He, ^{12}C, ^{16}O, ^{20}Ne, ^{24}Mg, ^{28}Si, ^{56}Fe and $\mu=2$ the Chandrasekhar equation of state (for the comparison).

In addition, the observational data of Sloan Digital Sky Survey Data Releases 4, 10 and 12 are analyzed[4,5,6]. The maximum, mean and minimum values of logarithm of surface gravity, effective temperature, mass and radius are found for each Data Releases. Moreover, the histogram and Gaussian distribution of mass and radius are constructed. The results clearly show that the consideration of white dwarfs using the Salpeter equation of state can explain the distribution of some white dwarfs from the SDSS DR 10 and SDSS DR 12, which cannot be interpreted by including only the finite temperature effects as inthe case of SDSSDR 4 [1b].

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STUDIES OF PHYSICAL PROPERTIES OF NEUTRON STARS

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The hypothesis of the existence of neutron stars was put forward by astronomers V. Baade and F. Zwicky immediately after the discovery of the neutron in 1932. But this hypothesis was confirmed only after the discovery of pulsars in 1967. Neutron stars are formed as a result of the gravitational collapse of normal stars with masses several times greater than the solar. The density of a neutron star is close to the density of the atomic nucleus, i.e. is 100 million times higher than the density of ordinary matter. Therefore, for its huge mass, the neutron star has a radius of only about 10 km.

Neutron stars are interesting and unusual physical objects. The outer crust of neutron stars, of course, consists of atomic nuclei, not neutrons. The surprising structure of neutron stars is very complex, the physical properties of which have not been thoroughly investigated. Some problems in the physics characteristics of neutron stars are concerns to the process of neutronization with a deepening into the bowels of the star, the corresponding equation of state, the gravitational field of neutron stars, etc. [1]

In the work [2] it was discussed that the strong gravitational field of neutron stars in the brany universe could be described by spherically symmetric solutions with a metric in the exterior to the brany stars being of the Reissner–Nordström type containing a brany tidal charge representing the tidal effect of the bulk spacetime onto the star structure.

In [3] it was studied the various linear responses of neutron stars to external relativistic tidal fields. It was focused on three different tidal responses, associated to three different tidal coefficients: