Abstract

Degree of Philosophy Doctor (PhD) thesis
6D060400 – Physics

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EXACT COSMOLOGICAL SOLUTIONS OF SOME MODELS GRAVITY WITH SCALAR AND FERMION FIELDS

Dissertation rationale. Since the discovery of the Higgs particle, it was clear that the scalar fields play a fundamental role in the high energy physics. Moreover, scalar fields become important also at the cosmological level.

In other words, research of scalar fields within various cosmological models is necessary. On the other hand it is known that the standard model includes not only scalar, but also fermion fields. It means that it is necessary to use also fermion fields in the description of cosmology of our Universe.

Gravitation models with scalar and fermion fields, or more exactly Friedman's generalized equations, can serve as the bridge between cosmology and the nonlinear equations of mathematical physics. In particular, it is shown in this thesis that such models can be written down in the form of the known equations of mathematical physics. Therefore, available solutions of the equations of Navier-Stokes, Painleve, Ramanujan can be used for research of properties of the chosen cosmological models.

Finally, use of models of this kind with scalar and fermion fields in cosmology can be important due to the fact that these models allow to the presence of a large number of parameters in scalar potentials, in uncommon functions of kinetic elements. Therefore, such potentials can be used for coordination of models with observation data.

In other words, it is expected that within models developed by us it is possible to describe various stages of evolution of cosmological evolution of the Universe where we lieve rather realistic.

Purpose of of the thesis – We will study exact solutions of some cosmological models, taking into account the contribute of scalar and fermionic fields, for early and late-time cosmic acceleration.

Object of the study – We will study the evolution of the Universe in different cosmological models.

Subject of the study - models of the Universe with scalar and fermion fields during era of domination of dark energy.

Methodological base of of the research – methods of the general theory of a relativity, methods of research scalar-fermion fields in the curved space, methods of research of the nonlinear differential equations.

Scientific novelty and scientific relevance of the thesis

Scientific novelty and scientific relevance of the thesis consist in development of new models of the Universe with scalar and fermion fields during era of domination of dark energy. Therewith:

− connection between Einstein's equations and Ramanujan's equations and Shezi is shown. On this basis the solution of the equations of Einstein with power characteristic for large-scale factor is constructed;

− equations of movement of a number of concrete models of fermion fields with f-essence for Friedman's metrics are found;

− cosmological Dirac-Born-Infeld model with f-essence is offered. Its decision which describes the late Universe with the condition equation like Tchaplygin's gas is found;

– generalization of cosmological model of Friedman in case of the equation of a condition of the substance which is looking like modified gas of Tchaplygin, or induced *f*-essence is given, and also its exact decisions are found.

For cosmology of *g*-essence with scalar-fermion interactions received the equations of movement and decisions for a large-scale factor with exponential and power series are found. Obvious expressions for potentials of scalar and fermion fields are found.**Approbation of the results:**

The results obtained in this thesis have been presented and discussed by:

International scientific conference of students, graduates and young scientists "LOMONOSOV-2013". Astana. 12-13 April 2013;

International conference "Actual problems of modern physics," dedicated to the 75th anniversary of academician MM RK Abdildin, Almaty. 15-16 March 2013;

International scientific conference "Chaos and structures in nonlinear systems. Theory and experiment." 8th International Scientific Conference dedicated to the 40th anniversary of the University named after Academician EA Buketov, Karaganda. 18-20 June 2012;

"X International Conference on Gravitation, Astrophysics and Cosmology", Vietnam, Quy Nhon, December 17th - December 22nd 2011

"III Italian-Pakistani Workshop on Relativistic Astrophysics", Lecce, 22 June 2011;

International scientific conference "Science and education - the leading factor in the strategy" Kazakhstan - 2030 "dedicated to the 20th anniversary of Independence of Kazakhstan. Karaganda. 23-24 June 2011;

International scientific conference dedicated to the 20th - anniversary of Kazakhstan's independence. Science and education as a leading factor in the strategy "Kazakhstan - 2030", June 23-24. Karaganda, 2011.

In addition, the results were presented and discussed at the seminars of the Department "General and Theoretical Physics" ENU. LN ENU and seminars "Eurasian International Center for Theoretical Physics."

Publication of the results. The results of this thesis have been presented in 16 published papers, five of which are articles in international journals with high impact factors; one article has been published in the foreign journal "Journal of Physics"; Conference Series: 3rd Italian-Pakistani Workshop on Relativistic Astrophysics; 3 articles have been published in periodicals of Republic of Kazakhstan, recommended by the Committee for the control and certification in the field of education and science of RK, hree in the proceedings of international conferences are not CIS, and 4 articles in the proceedings of international conferences of the CIS countries.

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