conferenceseries.com

Alexander M Krot, J Aeronaut Aerospace Eng 2018, Volume 7
DOI: 10.4172/2168-9792-C1-023

4th International Conference and Exhibition on

Satellite & Space Missions

June 18-20, 2018 | Rome, Italy

The stability of planetary orbits in extrasolar systems based on spectral representation of additional periodic force

Alexander M Krot
United Institute of Informatics Problems - NAS, Belarus

We need an explanation of the stability of planetary orbits of exoplanets moving around stars. This work applies the statistical theory of gravitating spheroidal bodies to explore the stability of planetary orbits in our solar system and other exoplanetary systems with regard to Alfvén–Arrhenius' oscillating force. The statistical theory of formation of gravitating spheroidal bodies has been proposed in our earlier works. Starting from the concept of forming a spheroidal body inside a gas-dust protoplanetary nebula, this theory solves the problem of gravitational condensation of a gas-dust protoplanetary cloud with a view to planet formation in its own gravitational field. Here we explain how Alfvén–Arrhenius's radial and axial oscillations modify the forms of planetary orbits within the framework of the statistical theory of gravitating spheroidal bodies. We find that periodic (or quasiperiodic) temporal deviation of the gravitational compression function of a spherically symmetric spheroidal body (under the condition of mechanical quasi-equilibrium) induces an additional periodic force. We show the specific additional periodic Alfvén–Arrhenius' force can be represented by the series of spectral components with multiply ordered frequencies to the average main circular frequency $\omega_1 : \vec{f}_a = \vec{f}_1^{(1)}(\omega_1 t, \vec{r}) + \vec{f}_1^{(2)}(2\omega_1 t, \vec{r}) + \vec{f}_1^{(3)}(3\omega_1 t, \vec{r}) + \ldots + \vec{f}_1^{(n)}(n\omega_1 t, \vec{r}) + \ldots$ In turn, if the additional periodic force becomes counterbalance to the gravitational force then the principle of an anchoring mechanism is realized in a planetary system, i.e. the stability of planetary orbits occurs. We also note that the spatial deviation of the gravitational potential of a rotating spheroidal body from a spherically symmetric one implies a difference in the values of the radial and the axial orbital oscillations, therefore the interference of these orbital oscillations can lead to the nonuniform rotation of stellar layers at different latitudes of star.

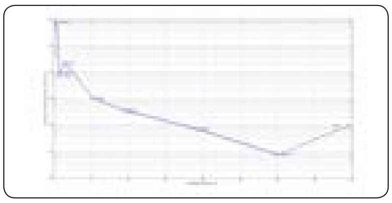

Figure 1: The plot of dependence of the amplitudes of additional periodic specific force f_a, m/s^2 on the planetary distance *d*, AU

Recent Publications

1. Alfvén H and Arrhenius G (1970) Structure and evolutionary history of the solar system. I. Astrophys. Space Sci. 8(3):338-421.
2. Krot A M (2009) A statistical approach to investigate the formation of the solar system. Chaos, Solitons and Fractals. 41:1481-1500.
3. Krot AM (2014) On the universal stellar law for extrasolar systems. Planet. Space Sci. 101:12-26.
4. Krot A M (2017) Ch 3 Development of the generalized nonlinear Schrödinger equation of rotating cosmogonical body formation. In the book: Complex Systems: Theory and Applications. 49-94.

Biography

Alexander M Krot, Professor, DSc received his PhD in 1985, then Degree of Doctor of Sciences (DSc) in 1991and Professor Degree in 1997. He is the Head of the Laboratory of Self-Organization System Modeling at the United Institute of Informatics Problems of the National Academy of Sciences, Belarus. His research interests are the analytical theory and computational modeling of self-organization processes and phenomena in complex systems (gas-dust protoplanetary media, aero-hydrodynamic viscous flows, nervous fibre, neural network structures etc.), statistical theory of planetary (stellar) system forming, theory of nonlinear analysis of attractors of complex systems, digital signal processing etc.

alxkrot@newman.bas-net.by