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Non-analytic relativistic r-modes of slowly rotating neutron stars

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Since 1997 the attempts to build the relativistic generalization of the Newtonian r-modes - predominantly toroidal oscillations, inherent to rotating neutron stars, - have lead to contradictory results concerning the properties of their frequency spectrum. While numerical calculations predict the discrete oscillation spectrum, theoretical studies in the slow-rotation approximation relying on traditional techniques predict the presence of continuous part in the spectrum. In this talk we present a new original approach to the study of relativistic perturbation equations. Within this approach under a number of assumptions we show, that relativistic r-modes form a class of non-analytic in stellar angular velocity solutions to the oscillation equations, characterized by discrete oscillation spectrum very similar to that of Newtonian r-modes. The elaborate analysis of the obtained equations in the limit of extremely slow stellar rotation allows to obtain the explicit expressions for the r-mode eigenfunctions and oscillation spectrum in this limit. We find no indications of the presence of the continuous part in the spectrum neither in theoretical analysis nor in numerical calculations.

Author: KRAAV, Kirill (Ioffe Physical-Technical Institute of the Russian Academy of Sc)

Presenter: KRAAV, Kirill (Ioffe Physical-Technical Institute of the Russian Academy of Sc)