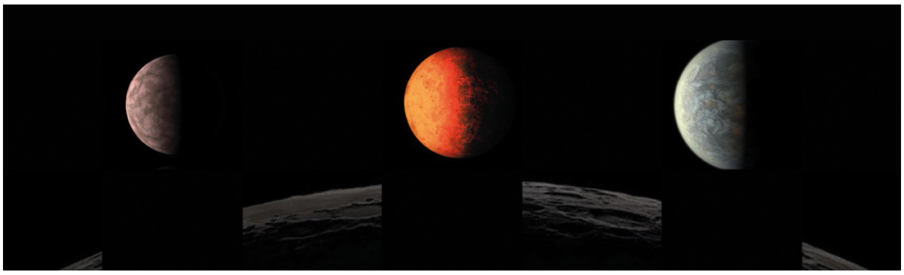

Contribution ID: **49**

Type: **Talk**

Elastic planetoids

Thursday 23 October 2025 15:35 (15 minutes)

Modeling the internal structure of self-gravitating solid and liquid bodies presents a challenge, as existing approaches are often limited to either overly simplistic constant-density approximations or more complex numerical equations of state. We present a detailed analysis of a tractable and physically motivated model for perfectly elastic, spherically symmetric self-gravitating bodies in hydrostatic equilibrium. The model employs a logarithmic equation of state (logotropic EOS) with a non-zero initial density and constant bulk modulus. Importantly, scaling properties of the model allow all solutions to be derived from a single, universal solution of an ordinary differential equation, resembling the Lane-Emden and Chandrasekhar models. The model provides new insights into stability issues and reveals oscillatory asymptotic behavior in the mass-radius relation, including the existence of both a maximum mass and a maximum radius. We derive useful, simple analytical approximations for key properties, such as central overdensity, moment of inertia, binding energy, and gravitational potential, applicable to small, metallic bodies like asteroids and moons. These new approximations could aid future research, including space mining and the scientific characterization of small Solar System bodies.

[1] B. Żbik & A. Odrzywołek. "Elastic Planetoids". Astrophys. J. 988.2 (2025), p. 267. doi: 10.3847/1538-4357/ade8ef

Primary authors: ODRZYWOŁEK, Andrzej (Jagiellonian University in Krakow); ŻBIK, Bartosz (Jagiellonian University in Krakow)

Presenter: ŻBIK, Bartosz (Jagiellonian University in Krakow)

Session Classification: Small bodies in the Solar System