

Author: C. LHOTKA

Space Research Institute (Austria)

Title: *“Stable Cassini states of a rigid body in the $p : q$ spin-orbit resonant problem. Application to Mercury”*

Abstract. We investigate generalized stable Cassini states in the spin-orbit resonant problem. Our study includes the study of the effect of the gravitational potential up to degree and order 4, and $p : q$ spin-orbit resonances with $p, q \leq 8$ and $p \geq q$. We derive new formulae that link the gravitational field coefficients with its secular orbital elements, and its rotational parameters. The formulae can be used to predict the orientation of the spin-axis and necessary angular momentum at exact resonance. We also develop a simple pendulum model to approximate the dynamics close to resonance and make use of it to predict the libration periods and widths of the oscillatory regime of motions in phase space. Our analytical results are based on averaging theory that we also confirm by means of numerical simulations of the exact dynamical equations. Our results are applied to the case of planet Mercury.