Author: P. TEOFILATTO
Università di Roma "La Sapienza" (Italy)
Title: *"Long-Term Capture Orbits for Low-Energy Space Missions"*

Abstract. In the last decades, low-energy trajectories in multibody environments have attracted an increasing interest by the scientific community, and some actual space missions have profited from the results of the studies on this subject. This research aims at ascertaining the existence and characteristics of natural long-term capture orbits around a celestial body of potential interest, such as an outer planet of the solar system. The problem is investigated in the dynamical framework of the three-dimensional circular restricted three-body problem. Previous numerical work on this subject has shown that two-dimensional, long-term capture orbits are topologically located in the proximity of asymptotic trajectories that converge toward libration periodic orbits. This numerical evidence substantiates Conley's theorem on the topology of capture trajectories. Moreover, topological methods lead to classifying all of the trajectories that belong to the plane of the two primaries. This work intends to extend the previous investigations to three-dimensional paths. In this dynamical context, several special trajectories exist, such as quasiperiodic orbits. These can be found as special solutions to the linear expansion of the dynamics equations, and have already been proven to exist even using the (complete) nonlinear equations of motion. The nature of long-term capture orbits is thus investigated in relation to the dynamical conditions that correspond to asymptotic trajectories converging into quasiperiodic orbits. Spacecraft dedicated to long-term planetary exploration could greatly benefit from the existence of similar capture orbits, because the propellant amount needed for long-term orbit maintenance would be reduced considerably.

Joint work with Mauro Pontani and Stefano Carletta.