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**Title:** *"Low-energy tour of the Galilean moons"*

**Abstract.** Motivated by current interest in the exploration of Jupiter's system, we designed a tour of Europa, Ganymede and Callisto based on the circular restricted three-body problem and Keplerian orbits. The former model is used to generate the initial conditions in the neighborhood of Lyapunov orbits of the collinear libration points of the several Jupiter-moon-spacecraft systems: these initial conditions may belong either to the invariant manifolds or to transit trajectories of the Lyapunov orbits. The latter type guarantees lower propellant cost, shorter flight times and an easier generation of the observation orbits around the moons. Out of the sphere of influence of the secondary, the three-body trajectories can be approximated by arcs of Keplerian ellipses with one focus at Jupiter. The intersection between elliptical arcs originating at two consecutive moons can be computed analytically. The difference in velocity at the intersection constitutes the cost of an individual moon-to-moon transfer. Exploring the intersections over a wide range of energies and at all the relative orientations would still be time consuming were it not for the important finding that the cheapest intersection between two elliptical orbits occurs when they are mutually tangent. This corresponds to a specific planetary configuration and remarkably reduces the search space. The link between consecutive moon-to-moon transfers in a tour that starts at Europa, visits Ganymede, continues to Callisto, returns to Ganymede and ends up at Europa is a problem of time matching or orbit phasing. The issue has been faced by designing the observation orbits around the intermediate moons (Ganymede and Callisto) in such a way as to add time flexibility to the trajectory thus ensuring the required phasing. These so-called re-phasing orbits increase the propellant consumption of the mission in the form of impulsive maneuvers of 100 m/s each. The complete tour takes 75 days and requires 4.5km/s of $\Delta v$. The replacement of the impulsive maneuvers with low-thrust arcs makes the tour affordable, although the time required for its execution increases considerably. We present these findings and we compare them with the open literature.

Joint work with A. Viale (Padua Univ., Italy), R. Castelli (Vrije Univ. Amsterdam, The Netherlands), K.C. Howell (Purdue Univ., USA).