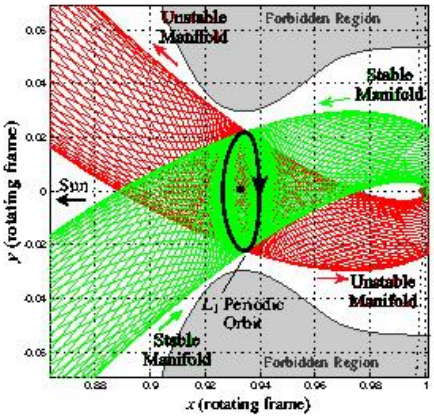
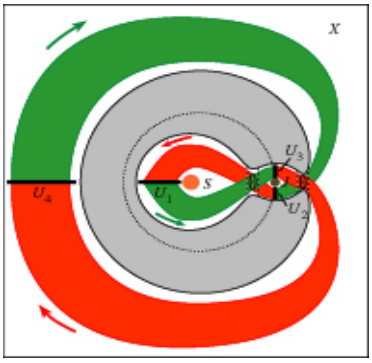
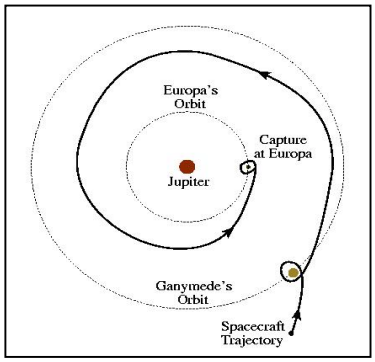
**PETIT GRAND TOUR: MISSION CONCEPTS TO OUTER PLANET SATELLITES USING NON-CONIC LOW ENERGY TRAJECTORIES.** M. W. Lo[1], [1]JPL 301-140L, 4800 Oak Grove Dr., Pasadena, CA 91109, Martin.Lo@jpl.nasa.gov

**Interplanetary Superhighway System:** Our Solar System is connected by a vast Interplanetary Superhighway System (ISSys) providing low energy transport throughout (see [1], [2]). The Outer Planets with their satellites and rings are smaller replicas of the Solar System with their own ISSys, also providing low energy transport within their own satellite systems. This low energy transport system is generated by all of the Lagrange points of the planets and satellites within the Solar System. Figure 1 shows the tubular passageways near L1 of Jupiter. Figure 2 shows the ISSys of Jupiter schematically. These delicate and resilient dynamics may be used to great effect to produce free temporary captures of a spacecraft by a planet or satellite, low energy interplanetary and inter-satellite transfers, as well as precision impact orbits onto the surface of the satellites.

**Petit Grand Tour:** Using modern dynamical systems methods, we have developed the theory and algorithms to compute global families of solutions with a near-arbitrary itinerary to serially tour the satellite system of any planet, to capture into orbit (temporary capture), depart, or land/impact the various satellites. This is the concept that we call "The Petit Grand Tour" (see [3], [4]). We present an example of such a transfer from Ganymede to capture into Europa orbit as well as a free transport (no propulsion needed, see Figure 3) between the Kuiper Belt and the Asteroid Belt computed using JPL's LTool. This spiral orbit flies by each of the Outer Planets starting at the Kuiper Belt before ending in the Asteroid Belt. A similar tour for the Jovian or Saturn system could be devised. This dynamics was used to designed the Genesis Mission soon to launch in the summer of 2001. We will also illustrate the use of this dynamics in an innovative concept for human servicing of observatory missions at the Sun-Earth L2.




**References:**

[1] Lo M. W. and Ross S. D. (1997) *SURFing the Solar System: Invariant Manifolds and the Dynamics of the Solar System, JPL IOM 312/97.*

[2] Koon W. S., Lo M. W., Marsden J. E., and Ross, S. D. (2000) *Heteroclinic connections between periodic orbits and resonance transition in celestial mechanics, Chaos V.10, #2, June*, 427-469.

[3] Koon W. S., Lo M. W., Marsden J. E., and Ross, S. D. (2001) *Resonance and capture of Jupiter comets, Celestial Mechanics (submitted).*

[4] Koon W. S., Lo M. W., Marsden J. E., and Ross, S. D. (2000) *Shoot the Moon, AAS Astrodynamics Conference, Clearwater Florida, Feb., Paper AAS –00-166.*