

**TWO BODY DYNAMICS AND THE VELOCITY STRUCTURE OF EJECTA BALLISTICS IN ANTIPODAL AND GENERAL TRAJECTORY RECONNECTIONS.** P. Jögi<sup>1</sup> and D. Paige<sup>1</sup>, <sup>1</sup>Department of Earth and Space Sciences, University of California at Los Angeles, Los Angeles, California 90095-1567.

**Introduction:** Recent data from the Lunar Reconnaissance Orbiter (LRO) outlines distinct regions of anomalous regolith and rock features with impact characteristics and of origination date contemporary with that of the antipodal Tycho crater [1]. It is argued [2] that highly energetic impacts upon susceptible surfaces will launch ejecta material with velocities vectors enabling flight trajectories reaching such antipodal locations. Analysis of the case of impacts on a nonrotating moon, in the absence of atmospheric dissipative forces, readily details an antipodal self focusing effect. This work concerns the analogous problem of a rotating moon.

**Our approach:** We consider the trajectory calculations to be well approximated by restricting attention to the dynamics of the classical two body problem [3]. Sections of Keplerian ellipses determine the ejecta ballistics and the dynamics is probed by letting a small set of parameters vary within appropriate intervals. This scheme allows any two points to be connected by an ejecta trajectory. The relative merits of such spatial pairings is therefore conveniently accessed. We specifically contrast antipodal ballistic connections with those of less spatial symmetry.

**References:** [1] Bandfield, et al., LPSC (2013) [2] Kring, D.A., and D.D. Durda (2002) *JGR*, 107, 10.1029/2001JE001532. [3] Tewari A. (2007) *Atmospheric and Space Flight Dynamics*, Birkhäuser, Boston, ch.4&5.

**Figure:** . A partial ejecta fan emanating from the top portion of the spherical boundary surface. The secondary impact locations are distributed along a circle at a fixed declination as described in an inertial frame. (Parallel view stereo pair.)

