Lunar apex-antapex cratering asymmetry as recorder of impactors in the Earth-Moon system

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The synchronous rotation of a planetary satellite ought to cause a spatial asymmetry in the crater production rate [e.g., Shoemaker and Wolfe, 1982; Neukum, 1984; Zahnle et al., 2001]. The crater production rate that has the maximum at the apex (equator, 90W) of the orbital motion of the satellite decreases with increase in angular distance from the apex and becomes the minimum at the antapex (equator, 90E). The degree of the apex-antapex cratering asymmetry primarily depends on the mean encounter velocity of impactors with respect to the planetary system and the orbital velocity of the satellite. This fact means that we can estimate the mean encounter velocity of impactors by observation of the apex-antapex cratering asymmetry. A validity of this technique has already been verified by Morota and Furumoto [2003]. From investigation of the spatial distribution for rayed craters of the Moon, they have estimated the mean velocity of recent impactors in the Earth-Moon system to be about 15 km/s corresponding to that of near-Earth asteroids. In this study, in order to improve the technique, we attempt to derive the relationship between the mean encounter velocity of impactors and the degree of the lunar apex-antapex cratering asymmetry as a function of time, considering the temporal variation in the lunar orbital velocity last 4.0 Gyr.