Secondary crater distribution around Tycho

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Ejection velocities and diameters of ejecta fragments that produced the secondaries can be estimated from the ranges from the center of the primary crater and the size of the secondaries (Vickery, 1986, 1987; Hirase et al., 2004). The size-velocity relation of impact fragments is a fundamental part of the study of impact disruption and impact cratering. We present the results of analysis of secondary craters around a lunar crater Tycho (D = 85 km). Besides some studies on its distant ray system and associated secondary craters, there is no previous report on the secondary crater distribution around Tycho.

The size-velocity distributions of ejecta fragments are estimated on three selected regions at east of Tycho. The ranges from the center of Tycho to the analyzed regions are about 130, 250, and 360 km, respectively.

All estimated size distributions are on the power-law function of the power index about 2.5, and they are independent from ejection velocities. O'Keefe and Ahrens (1985) assumed that the distribution of ejecta fragments at given velocity has the same form as the distribution of fragments of all velocities in a model of mass distribution of fragments from impact and explosion craters. Our results is an observational confirmation of this assumption.

The size frequency distribution of secondary crate also provides a new insight on a well-known debatable subject on the origin of slope steeping between 0.3 and 4 km in crater diameter. The value of the power-law index 3.4 for secondary crater size of Tycho is in accordance with that of previous investigations on lunar secondary craters and on experimental nuclear explosion craters by Shoemaker (1965). This result supports a secondary crater hypothesis for the slope steeping of the size-frequency distributions.