LUNAR IMPACT BASIN POPULATION AND ORIGINS REVEALED BY LOLA AND GRAIL G. A. Neu-

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Introduction: The Lunar Orbiter Laser Altimeter (LOLA) [1] and Gravity Recovery and Interior Laboratory (GRAIL) [2] missions created the basis for a global assessment of the crustal structure of the Moon [3] and the history of impact structures, in particular those of diameter exceeding ~200 km known as basins [4, 5]. The cumulative size-frequency distribution (CSD) of lunar basins has previously been estimated from imperfect data and was uncertain by factors of two or more, but no significant revisions to the numbers and sizes of basins since GRAIL are anticipated.
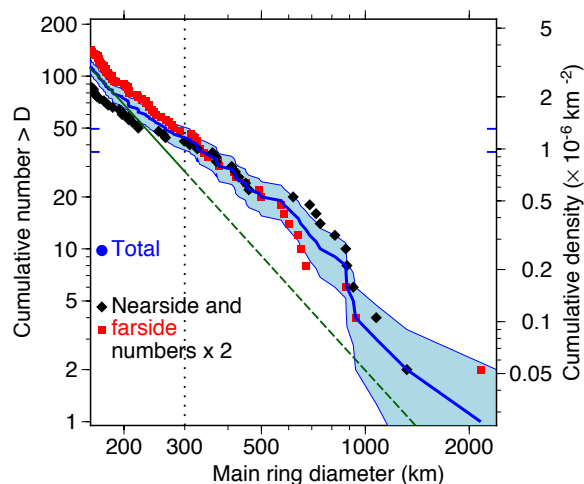

Figure 1: Cumulative size-frequency distribution for complex craters and basins [4]. The blue line shows data for all the craters and basins in Table 1. The shaded region spans the 1-SD error estimates. Black diamonds and red squares show the cumulative size-frequency distributions for nearside and farside craters, respectively, normalized by area; for these symbols, the cumulative number scale on the left reads two times the value. Blue horizontal ticks show confidence limits of N(300) for the overall population. The cumulative Hartmann production function [6] for craters larger than 64 km is shown by the green line with a slope of −2.2, extrapolated for diameters larger than 300 km (vertical dotted line). The main ring diameter was inferred from the diameter of the central Bouguer

anomaly high for basins observed in GRAIL data that lack an outer topographic rim.

The CSD shown in Fig. 1 does not differ greatly from earlier Hartmann power-law production function [6], apart from uncertainties in the determination of the principal diameter of the basins, particularly those that possess multiple rings. GRAIL gravity data allow the exclusion of several incorrect identifications and confirm the existence of basins for which the topographic signature has been obscured by subsequent crater formation. The known relations among the diameters of a peak ring, the central Bouguer anomaly, and the main basin rim allow us to estimate the approximate size of basins that lack confidently measurable topographic rings. The precision of GRAIL is allowing the detection of one or more previously unknown craters using gravity gradiometry [7] for smaller sizes where the population is denser but less uniform [5].

The size of impactors in relation to the basin population is, however, a matter of current debate [8–10]. As well, the population and dynamics of the early solar system giving rise to a proposed cataclysmic bombardment continues to be discussed [11–13]. The integration of current lunar datasets will have strong bearing on the cratering flux and crater retention ages for the other terrestrial planets, because it is the lunar cratering rate that anchors the impact chronology for the entire inner solar system.

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