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Surveying the Long-Period Comet Hazard

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ABSTRACT

Long period comets (LPCs), comets that have greater than a 200-year orbital period, are the least-characterized population bound to our solar system that present an impact threat. Size distributions for the larger bodies, with diameters ~1km or greater, have been constrained, but significant margins of uncertainty remain. The latest and most successful survey that has yielded population and size constraints is the NEOWISE survey (Bauer et al. 2017; Mainzer et al. 2014). The NEOWISE debiased numbers suggest about 7 long-period comets 1km or larger in size come within 1.5 AU of the Sun. A comparison with present observations over the last 8 years suggests about 4.25 comets per year are detected that come within 1.5 AU on average, regardless of size. Probably more than half (about 60%) are detected, but

a few remain undetected, assuming most of what is detected have nuclei with diameters near or greater than 1km. Few surveys have been debiased as thoroughly as the NEOWISE observations. Largely, this is owing to the variable nature and complexity of debiasing ground based surveys, that are subject to seeing and weather considerations that space-based surveys are not. Francis (2005) attempted to debias the LINEAR survey, with limited success. The comparable long-period comet flux derived from that work arrived at approximately 3-4 comets per year within the same perihelion range and size range (q<1.5AU, diameter > 0.99 km). It's worth noting that for the past 5 years, since Chelyabinsk, when the full-sky surveys received a boost in resources, the detection of comets have reached or exceeded the rate of 4 comets per year q<1.5AU.

Compared to NEOs, for objects down to similar size ranges, LPCs remain a significantly lower threat, by a factor of ~1000 (Stokes et al. 2017 and Bauer et al. 2017), based on presently observed populations. However, these bodies remain elusive, and their detection, let alone identification of near-impact threats, are characteristically and comparatively brief relative to their 1-AU crossing times (Stokes et al. 2017). Comets are typically discovered at distances of a few AU, and so often have intervals of < 1 year from discovery before they pass within 1 AU of the Sun. We will discuss the present state of the constraints on the LPC impact threat, and the advantages near-future surveys may bring to characterizing it as well as identifying future LPC impact threats.

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