## Observations of Asteroid 2003EH1, Possible Parent Body of the Quadrantid Meteoroid Stream

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## Abstract

The near-Earth asteroid (196256) 2003 EH1 is associated with, and is presumed to be the parent body of, the Quadrantid meteoroid stream [1,2,3,4,5,6]. Our photometric observations investigate the physical properties of the asteroid and its possible relation to the stream. No evidence for on-going mass-loss is found (Fig. 1). Surface brightness profile at 2.1 AU limits the fractional contribution to the integrated brightness by near-nucleus coma to < 2.5 %. We find that the effective nucleus radius is  $r_e = 2.0 \pm 0.2$  km using the assumed value of an typical albedo for cometary nuclei ( $p_{\rm B}=0.04$ ). A rotational period of  $12.650\pm0.033$  hr is derived by fitting the time-resolved R-band photometry (Fig. 2). The photometric range of the lightcurve,  $\Delta m_{\rm B} = 0.44 \pm 0.01$  mag, indicates an elongated shape having an axis ratio  $\sim 1.5$  projected onto the sky plane. The colors of the asteroid are consistent with those of C-type asteroids (Fig. 3). The maximum mass loss rate deduced from a model fitted to the profile is  $\leq 2.5 \times$  $10^{-2}$  kg s<sup>-1</sup>. Water ice can occupy a fraction of the surface no larger than  $f_A \lesssim 10^{-4}$ . Current dust production from 2003 EH1 is orders of magnitude too small to supply the mass of the Quadrantid core meteoroid stream  $(10^{13} \text{ kg})$  in the 200?500 year dynamical lifetime [1,3,6]. If 2003 EH1 is the source of the Quadrantids, we infer that mass must be delivered episodically, not in steady-state.

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Figure 1: The 360 second integrated *R*-band image of 2003 EH1 taken by Keck-I 10 m on UT 2013 October 2. The frame size is  $40^{''} \times 25^{''}$ . The object has a FWHM of  $0.86^{''}$ , neither coma nor tail is visible.



Figure 2: The two-peaked rotational light curve has a period  $P_{\rm rot}$ =12.650±0.033 hr.



Figure 3: Color plots (V - R vs. B - V) for 2003 EH1 (blue) on weighted mean with those of the Tholen taxonomic classes and the Sun (red).

## References

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