138175 (2000 EE104) and the Source of Interplanetary Field Enhancements

David Jewitt  
University of California at Los Angeles (jewitt@ucla.edu)

We present the first optical observations taken to characterize the near-Earth object 138175 (2000 EE104). This body is associated with Interplanetary Field Enhancements (IFEs), thought to be caused by interactions between the solar wind magnetic field and solid material trailing in the orbit of the parent body. Based on optical photometry, the radius (in meters) and mass (in kilograms) of an equal-area sphere are found to be $\frac{250}{(0.1/p)^{1/2}}$ and $1 \times 10^{11} (0.1/p)^{3/2}$, respectively, where $p$ is the red geometric albedo and density 1500 kg/m$^3$ is assumed. The measured colors are intermediate between those of C-type (primitive) and S-type (metamorphosed) asteroids but, with correction for the likely effects of phase-reddening, are more consistent with a C-type classification than with S-type. No evidence for co-moving companions larger than $40(0.1/p)$ meter in radius is found, and no dust particle trail is detected, setting a limit to the trail optical depth $< 2 \times 10^{-9}$. Consideration of the size distribution produced by impact pulverization makes it difficult to generate the mass of nanodust (minimum 1 $\times$ 10$^5$ kg to 1 $\times$ 10$^6$ kg) required to account for IFEs, unless the size distribution is unusually steep. While the new optical data do not definitively refute the hypothesis that boulder pulverization is the source of IFEs, neither do they provide any support for it.