Unexpected D-type interlopers in the inner main belt

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Very red featureless asteroids (spectroscopic D-types) are expected to have formed in the outer Solar System far from the Sun [1,2]. They comprise the majority of asteroids in the Jupiter Trojan population, and are also commonly found in the outer main belt and among Hildas. The first evidence for D-types in the inner and middle parts of the main belt was seen in the Sloan Digital Sky Survey (SDSS) [3].

Here we report follow-up observations of SDSS D-type candidates in the near-infrared. Based on follow up observations of 13 SDSS D-type candidates [4], we find a ~ 20 % positive confirmation rate. Known inner belt D-types range in diameter from roughly 7 to 30 km. Based on these detections we estimate there are ~ 100 inner belt D-types with diameters between 2.5 and 20 km. The lower and upper limits for total mass of inner belt D-types is 2×10^{16} kg to 2×10^{17} kg which represents 0.01–0.1 % of the mass of the inner belt [5].

The inner belt D-types have albedos at or above the upper end typical for D-types [6] which raises the question as to whether these inner belt bodies represent only a subset of D-types, they have been altered by external factors such as weathering processes, or if they are compositionally distinct from other D-types. All D-types and candidates have diameters less than 30 km, yet there is no obvious parent body in the inner belt. Dynamical models (e.g., [7]) have yet to show how D-types originating from the outer Solar System could arrive at the inner reaches of the main belt under current scenarios of planet formation and subsequent Yarkovsky drift.

Acknowledgements: This material is based upon work supported by NASA under grant number NNX12A L26G and through the Hubble Fellowship grant HST-HF-51319.01-A.

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