A kilometre-sized Kuiper belt object revealed by OASES stellar occultation observations

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We will report the first detection of a single stellar occultation event candidate by a kilometer-sized (radius= 1-10 km) Kuiper belt object (KBO). Since the kilometer-sized KBOs are too faint to be detected directly, the monitoring of stellar occultation events is one possible way to discover them. With the aim of detecting the stellar occultation events, we launched an optical observation project named Organized Autotelescopes for Serendipitous Event Survey (OASES). We installed two low-cost OASES observation systems in different positions on the rooftop of the Miyako open-air school on Miyako Island, Miyakojima-shi, Okinawa Prefecture, Japan, and monitored up to 2000 stars simultaneously with a sampling cadence of 15.4Hz. In the 60-hour dataset obtained with the two-year OASES observations, we discovered one occultation candidate event by a KBO with a radius of approximately 1.3 km. Our present detection yields a surface number density of KBOs with radii exceeding 1.2 km is approximately 6×10^5 deg^{-2}. This surface number density favors a theoretical size distribution model with an excess signature at a radius of 1–2 km. The present results suggest that planetesimals before their runaway growth phase grew into kilometer-sized objects in the primordial outer Solar System and remain as one of the major populations in the present-day Kuiper belt.

Keywords: trans-Neptunian objects, Kuiper belt , ground based observations by optical telescopes

