Asteroid (3200) Phaethon and the Geminid meteoroid stream complex

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The Geminid meteor shower is one of the most intense and regular of the annual showers. It has been regularly observed so that its structure is known in some detail. A qualitative model of the stream, which sums up a 20-years sequence of publications [1,2], explains most of the stream's features. The activity profile for the Geminid shower has a distinctive shape, a shape that is generated by a cometary model of the stream generation, that is, where ejection persists over a significant fraction of the orbit. Asteroid (3200) Phaethon was discovered in 1983 and is now generally regarded as being the parent body of the Geminid meteoroid stream. No cometary activity has ever been observed on Phaethon, but in 2009 and in 2011 when near its perihelion it brightened briefly, which could be interpreted as being due to the ejection of dust particles [3]. The dynamical and spectral properties of Phaethon appear to support the asteroidal nature of the object. Apollo asteroid 2005 UD has a very similar orbit to Phaethon and is a likely candidate or being a kin to Phaethon and/or the Geminid stream. Another candidate for the Phaethon–Geminid complex is Apollo asteroid 1999 YC, so that a comet progenerator may be responsible for the stream and the three asteroids. The dynamics of these objects was studied in order to understand their origin and the mechanism for their decoupling. High-quality Geminid orbits obtained recently by double-station video set-up in the Canary Islands were used to study their possible relations to 2005 UD and 1999 YC.

References: [1] Ryabova, G.O. (2007) MNRAS, 375, 1371–1380. [2] Ryabova, G.O. (2008) EMP, 102, 95–102. [3] Williams I.P., Ryabova G.O. (2011) MNRAS, 415, 3914–3920.