

News from the Main Belt Comet 133P/Elst-Pizarro

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Abstract

Until now, only three Main Belt Comets (MBCs) are discovered, although a lot more are expected to exist. MBCs are intriguing solar system objects: they are in asteroid-like orbits, but behave – at least during parts of their revolution around the Sun – like a comet, i.e. they display coma and tail. They were very likely formed in the Main Belt and somehow managed to emit dust – and most likely gas as well – even after 4.6 Billion years in orbit. Thus, MBCs may be the linking objects between asteroids and comets. When discovered in 1996, 133P/Elst-Pizarro (133P) was the first MBC. It may be a member of a collision family in the belt and its activity is recurrent.

New imaging and polarimetric observations of 133P, performed with FORS1 at the ESO VLT during the 2007 perihelion passage of the object, allowed further characterization of the MBC. The photometric and polarimetric phase functions indicate significant differences to those of most asteroids except for F-types. They also differ from that of 2P/Encke, the only cometary nucleus measured to this respect [1]. The empiric albedo-polarimetry relationship gave an albedo value of the nucleus of 6 percent which is in agreement with results from Spitzer measurements of the objects published recently [2]. The nucleus size is estimated to be 2km in radius. The VR broadband color and the polarization color is rather neutral indicating a flat spectrum of the nucleus. The combined deep polarimetric images of 133P reveal activity during most of the observed orbit arc (end of May to end of September 2007): The temporal evolution of the tail shows that the nucleus activity started in the second half of May 2007, i.e. the nucleus emitted dust from about one month before (!) perihelion and continuously until at least end of September 2007. Like in 1997 two tails were

observed in August 2007: a tail and an anti-tail, around the time when the Earth viewing direction sliced through the tail of 133P that is oriented mostly along the extended radius vector of the object. As already measured in 1997 [3], the dust tail appearance in 2007 suggests rather low emission velocity of the dust, just 1.5-2 m/s.

In summary: 133P is a small body which displays activity from shortly before perihelion to almost one year thereafter [4]. It has low albedo and may be of F-type taxonomy. Although its activity level is low, it would have exhausted the body by far over the lifetime in the solar system. Hence, one can conclude that the activity of MBCs is temporary and recent, maybe initiated by a singular event (for instance an impact; [5]). This scenario may imply that MBCs manage to keep a reservoir of a driving agent (water ice?) for the activity over billion of years.

References

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