

## **Analysis of the dynamical evolution of the Quadrantid meteor stream between AD 1760 and 2020**

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The Quadrantids is one of the strongest meteor showers. The core of the Quadrantids is only 200-300 years old and is associated with asteroid (196256) 2003 EH1 while wide part of stream is connected with comet 96P/Machholz. The asteroid 2003 EH1 is expected as a dormant or recently extinct comet in many works (Jenniskens, 2004; Williams et al., 2004; Wiegert & Brown, 2005; Abedin et al., 2015). The simulation particles of meteor stream ejected from asteroid (196256) 2003EH1 under investigation moves in the following mean motion near-resonances: 2/1 with Jupiter, 1/3 with Mars and 1/9 with Venus. The motion of these objects has considered to be chaotic in a short time scale, and the close encounters with Jupiter are supposed to be the cause of the fast chaos. Another reason is that a non-resonant state near the mean motion resonances 2:1J, 1:3M and 1:9V has a strong influence on the motion of the Quadrantid meteor stream between AD 1760 and 2020. This “weak chaos” is largely confined to the true anomaly. Consequently, the shape of the orbit can be computed reliably over much longer time scales than can the body’s position within the orbit.

The parameter MEGNO increases for the simulation particles of meteor stream moving around the Sun and perturbed by the planets. High value the parameter MEGNO are due to frequent changes in semimajor axis induced by close encounters with Jupiter. In particular those encounters that are frequent and not so far from the radius of the Hill’s sphere. We finally note that the chaotic behavior of the simulation particles of meteor stream caused by close encounter with planets is of additional nature to the studied chaos related to mean motion or secular resonances.

### References:

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