# April ρ Cygnids

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We examined the recently-established April ρ Cygnids meteor shower (ARC, IAU#348), discovered by the Canadian Meteor Orbit Radar survey (CMOR; Brown et al., 2010), and later confirmed by video observations made by the Cameras for Allsky Meteor Surveillance project (CAMS; Phillips et al., 2011). As reported by Neslusan and Hajdukova (2014), ARC is suspected to be a part of a broader meteor shower complex, possibly associated with the long-period comet C/1917 F1 (Mellish). According to their model, one of the filaments of the meteoroid stream originating from the comet corresponds to the April ρ Cygnids. However, the similarity between the mean characteristics of the predicted and the real showers is not clear. Here, we present a dynamical study of the April ρ Cygnids orbits, extracted from several catalogues, using the Rudawska et al. (2014) identification method. The catalogues used include the EDMOND database (Kornos et al., 2014 a, b) and the SonotaCo shower catalogue (SonotaCo, 2009). The results of the orbital evolution of the comet and orbits of the ARC, including the published orbits of ARC from CMOR and CAMS, are presented. The conclusion as to their common origin is also discussed.

## 1 Summary

In order to check a possible link between the April ρ Cygnids and the comet Mellish, the orbital evolution of the comet and the ARC were studied. The behavior of the orbital elements of the comet C/1917 F1 (Mellish) reconstructed backwards for 50000 years was compared with the corresponding evolution of the orbital elements of the April ρ Cygnids, determined from the various meteor databases.

We selected April ρ Cygnids from the EDMOND and SonotaCo databases (44 and 21 orbits, respectively) using an independent identification method proposed by Rudawska et al. (2014). The weighted mean values of the orbital elements and geocentric parameters for each sample were determined. Moreover, we used the mean parameters of published orbits of ARC provided by CMOR and CAMS. The nominal orbit of the C/1917 F1 and four mean orbits of the ARC were numerically integrated backwards. In this integration, each ARC orbit is represented by 18 modeled particles distributed equidistantly by 20 in mean anomaly.

The modeled particles of the ARC from all four datasets move in very distinct orbits in comparison to each other, as well as to the relatively stable orbit of the comet C/1917 F1 (Mellish). This raises the question whether the selected particles from the different data correspond to the same meteor shower. However, 11 from 18 particles, modeled along the mean orbit of the ARC determined by Brown et al. (2010), undergo the same orbital evolution ($D_{SH} < 0.1$) as the comet Mellish for the time period from about 42000 to 44000 years. This could support the ARC association with the comet. On the other hand, the particles modeled along the mean orbits from the other three datasets do not support their common origin. All 18 particles modeled along the mean orbit determined by Phillips et al. (2011) show similar orbital evolutions to the comet only in the short period from -1600 to -2000 years; after that their orbits split. Theoretical particles along the SonotaCo ARC mean orbit behave similarly to the comet only in the time period about -8000 to -11000 years. In the EDMOND catalogue, none of the particles modeled show a similarity in their evolution to the comets' orbit under the $D_{SH} = 0.1$, and only 9 theoretical particles under $D_{SH} = 0.15$, for the time about 11000 years before the present.

The obtained results did not allow us to draw any clear conclusions about the association of the ARC with the comet C/1917 F1 (Mellish). The precision of the comet Mellish-orbit determination (Asklöf, 1932) is, unfortunately, not very high. The probability of a significant discrepancy with reality increases when integrating this orbit backward in time. Moreover, we know that the geocentric velocity of a meteoroid orbit is usually a poorly determined parameter; similarly, the eccentricity of a meteoroid orbit. This is then reflected in a poor determination of the corresponding semi-major axis and influences the results of the integration.

## Acknowledgment

This work was supported by the Slovak Grant Agency for Science VEGA, grant No 1/0225/14, and by the Slovak Research and Development Agency under the contract No. APVV-0517-12.

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