EPSC Abstracts,
Vol. 4, EPSC2009-602, 2009
European Planetary Science Congress,

Comparison between dust trails in different streams

D.J. Asher

Armagh Observatory, College Hill, Armagh, BT61 9DG, UK

Dust trails

An active comet releases new material on each return to perihelion. These meteoroids soon extend into a long trail, which generally survives as a dense, narrow structure for several revolutions before dispersing into the background stream associated with the comet in question. The Earth's passage through trails causes sharp meteor outbursts. Meteor activity from a stream thus has a background component (older meteoroids) and possible shorter duration components each associated with a trail formed at a given perihelion return.

Mapping out the dust trail structures has allowed precise meteor shower predictions for various streams, and in most detail for the Leonids [1,2,3,4]. A further example is Lyytinen's [5] discovery that on 2009 August 12, around 9h UT the Earth will come quite close to the Perseid trail generated at the 1610 return of 109P/Swift-Tuttle. A test calculation using the MERCURY integrator package [6] and methods developed in [4] confirms that the nominal miss distance from the Earth's orbit is only about ten Earth diameters. Calibration with observations has shown that such miss distances in the case of the Leonid stream have been associated with near storm level activity.

Ejection velocities

However, there is no reason to suppose that the width of a newly formed trail should be the same in different streams. Differing orbital geometries of the parent comets, e.g. 55P/Tempel-Tuttle versus 109P/Swift-Tuttle, can be significant, as can the size of the parent comet, which influences ejection speeds [7].

The width and density profile of a trail at 1 AU from the Sun is closely related to the velocities with which the meteoroids were ejected from the comet [8,9]. The techniques of [10] can be used to generate trail cross sections, enabling comparisons between trails in different streams, such as the Perseids versus the Leonids.

References

[1] Kondrat'eva, E.D. and Reznikov, E.A. (1985) *Sol. Syst. Res.*, 19, 96–101.

[2] Kondrat'eva, E.D. et al. (1997) *Sol. Syst. Res.*, 31, 489–492.

[3] Lyytinen, E. (1999) *Meta Res. Bull.*, 8, 33–40.

[4] McNaught, R.H. and Asher, D.J. (1999) *WGN*, 27, 85–102.

[5] McBeath, A. (2009) *IMO Meteor Shower Calendar*, `http://www.imo.net/calendar/2009`

[6] Chambers, J.E. (1999) *MNRAS*, 304, 793–799.

[7] Whipple, F.L. (1951) *ApJ*, 113, 464–474.

[8] Ma, Y. and Williams, I.P. (2001) *MNRAS*, 325, 379–384.

[9] Asher, D.J. and Emel'yanenko, V.V. (2002) *MNRAS*, 331, 126–132.

[10] Asher, D.J. (2008) *Earth, Moon & Planets*, 102, 27–33.