DECOHERENCE TIME SCALES FOR METEOROID STREAMS

B. J. Gladman[1] and A. D. Pauls[1]. [1]Department of Physics and Astronomy, University of British Columbia, Vancouver, Canada. Contact author e-mail: gladman@astro.ubc.ca

Introduction: We have explored [1] the orbital dynamics of a Earth-crossing objects with the intent to understand the time scales under which an `orbital stream' of material could produce time-correlated meterorite falls. These `meteorite streams' have been suggested to be associated with several well-known meteorite-dropping fireballs (Innisfree [2], Peekskill [3], and most recently Pribram [4]). These are distinguished from meteor streams by the fact that these streams would consist of huge numbers of objects large enough to drop recoverable meteorites. We have studied the statistical significance of some published claims for such meteoroid streams.

Statistical studies: We performed three different analyses of the statistical significance of the 'orbital similarity' in the published cases, in particular calculating how often orbits of the same level of similarity would come from a random sample of meteoroids with a similar pre-atmospheric orbital distribution. We found that in all cases the level of orbital coincidence (be it a single pair of nearby orbits or a cluster of similar orbits) observed is that expected from a random orbital distribution of Earth-crossing orbits which obey the known (a,e,i) distribution of Earth-crossing material. We conclude there is no statistically significant evidence for Earth-crossing meteoroid streams.

Numerical studies: We also performed [1] extremely detailed numerical studies of the time evolution of the stream candidates. We find that if they were streams of objects in similar orbits to the observed fireballs then these streams of material would become `decoherent' (in the sense that the day of fall of meteorites of these streams become almost random) on times scales of a few tens of thousands to a few hundred thousand years. Thus, an extremely recent breakup would be required, much more recent than the cosmic ray exposure ages of the recovered falls in each case.

References:

[1] A. D. Pauls and B. J. Gladman 2004. *Meteoritics and Planetary Science.* submitted. [2] Halliday, I. et al. 1987. *Icarus* 69:550-556. [3] Lipschutz, M. et al. 1997. *Planetary and Space Science*e 45:517-523. [4] Spurny, P. et al. 2003. *Nature* 423: 151-153.