Some Evolving Thoughts Regarding Radar Meteor Observations

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Radar meteor research, once declared "dead" (Gilbert, G. N. (1977), Growth and decline of a scientific specialty: The case of meteor radar research, *EOS Trans. AGU*, *58#5*, 273-277.), has in its modern manifestation proven resilient, informative, and stimulating as this research requires integration of many disciplinary and cross-disciplinary areas. These areas include our favorite subject, radio science, as it applies to the meteor head- and trail-echo scattering as well as non-equilibrium plasmas and planetary and solar system evolution among many others. Thorough understanding of the radio science aspects of radar meteors is required to correctly interpret observations—for example, it has been argued that meteoroid fragmentation is dominant in even classical trail-echo radars (Elford, W. G., M. A. Cervera, and D. I. Steel (1994), Single station identification of radar meteor shower activity: the June Librids in 1992, *Mon. Not. R. Astron. Soc.*, *270*, 401-408.). This understanding depends on mutually informed and evolving observational techniques and modeling studies. It must also depend on testing the radar meteor results against those of related areas such as optical meteor studies. In particular, very low-light TV (LLTV) camera systems have convincingly revealed meteors with beginning heights up to ~200 km (Koten, P., P. Spurny, J. Borovicka, S. Evans, A. Elliot, H. Betlem, R. Stork, and K. Jobse (2006), The beginning heights and light curves of high altitude meteors, *Meteor. Planet. Sci.*, *41*, 1305-1320.) thus extending the "meteor zone" from below 80 km to at least 200 km. Further, the LLTV observations show the transition from sputtering above to ablation below with the transition occurring near 120 km altitude. Fragmentation is found to be a factor in high altitude optical meteors. This raises the question of why high altitude radar meteors (HARM) have not been widely observed. We report on some progress in this arena and on other likely meteor related phenomena that hint of important transient electrodynamic phenomena.