The formation and early evolution of meteoroid streams

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ABSTRACT

Meteor showers occur when the Earth encounters a stream of particles liberated from the surface of a comet or, more rarely, an asteroid. Initially, meteoroids follow a trajectory that is similar to that of their parent comet but modified by both the outward flow of gas from the nucleus and radiation pressure. Sublimating gases impart an "ejection velocity" to solid particles in the coma; this ejection velocity is larger for smaller particles but cannot exceed the speed of the gas itself. Radiation pressure provides a repulsive force that, like gravity, follows an inverse square law, and thus effectively reduces the central potential experienced by small particles. Depending on the optical properties of the particle, the speed of the particle may exceed its effective escape velocity; such particles will be unbound and hence excluded from meteoroid streams and meteor showers. These processes also modify the heliocentric distance at which meteoroid orbits cross the ecliptic plane, and can thus move portions of the stream out of range of the Earth. This talk presents recent work on these components of the early evolution of meteoroid streams and their implications for the meteoroid environment seen at Earth.