Accretion of matter by the Sun: influence on the solar corona

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A comparative study of single-body meteor ablation in the atmosphere of the Earth and in the solar corona will be presented for a wide range of masses, composition and entry velocities of meteoroids. The minimum mass inflow required to change significantly the heavy ion composition in the upper layers of the terrestrial ionosphere and of solar corona will be calculated. Similarly we will estimate the minimum rates of kinetic energy deposition that are necessary to enhance significantly the temperatures of the layers where meteoroids experience their maximum deceleration rate and dissipate their incident kinetic energy.

Our single-body meteor ablation model is similar to those developed by Campbell-Brown and Koschny (2004) for the Earth's atmosphere and by McAuliffe and Christou (2005) for the case of the atmosphere of Venus.

In the Earth's upper atmosphere, it has long been known that the ablation of meteors gives rise to permanent layers of neutral and ionized metal atoms at altitudes between 80 and 100 km. On the other hand, the temperature of the terrestrial mesosphere is not significantly affected by the accretion of meteoritic material and the kinetic energy deposited, except maybe during extremely intense meteor showers.

The actual effects of infalling meteoroids on the coronal heavy ions composition and temperature distributions have not been investigated so far. As a starting point, we propose to adapt the meteor ablation model used for the atmospheres of Earth and Venus to the case of the solar corona. However the heliospheric distribution of meteoritic material inflow is poorly known close to the Sun and needs to be determined inside 1AU, as well as outside the ecliptic plane. Due to the one-dimensional nature of the model, we will simply extrapolate the cumulative mass distribution of Ceplecha et al (1998) observed at 1 AU and use a reasonable velocity spectrum for the infalling meteoroids to determine the mass and heat deposition rates as a function of altitude. Later, a more accurate three-dimensional model will be considered. We plan to use various other sources - for example the IAU Meteor Data Center in Lund, Sweden, the AMOR project in New Zealand, and the European Fireball Network, and the Ulysses Data – to approximate the mass and velocity distributions of meteoroids close to the Sun. The values presented in this study should therefore be considered as a first order of magnitude evaluation..