

Momentum transfer to fluffy dust aggregates from stellar winds

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Dust-plasma interaction may play a dominant role in the dynamics of dust particles around young main-sequence stars. Circumstellar dust is expected to be an aggregate consisting of small grains. The momentum transfer cross section for an aggregate is a key quantity for determining the lifetimes of circumstellar dust disks.

We formulate the momentum transfer cross section of fluffy dust aggregates and propose an algorithm for computing the cross section. We compare the magnitude of the plasma and photon Poynting-Roberson effects (PR effects).

We find an empirical formula that well approximates numerical results for the momentum transfer cross sections. A comparison of the magnitudes of the PR effects shows that the lifetime of debris dust around young main sequence stars is shorter by orders of magnitude than that estimated by taking account the photon PR effect alone. Brief discussion is given on the plasma PR effect for dust debris disks around young main sequence stars.