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Collapse and Fragmentation of a Primordial Filamentary Cloud Revisited

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Gravitational collapse and fragmentation of a filamentary cloud in the context of primordial star formation is reinvestigated. With and without the effect of external far-ultraviolet radiation, dynamical and thermal evolution of a collapsing filament is calculated using so-called one-zone models as well as one-dimensional numerical hydrodynamics with taking into account non-equilibrium chemical reactions and the photodissociation of molecular hydrogen owing to the external far-ultraviolet radiation. With the effect of the external far-ultraviolet radiation, a filamentary cloud with moderate line mass tends to collapse adiabatically in low density regime ($n < 100/\mathrm{cm}^3$). By considering fragmentation in this adiabatic phase in addition to the fragmentation around the loitering point, the effect of external dissociation radiation increases fragment mass.