Thermal and Hydrostatic Structure of the Protoplanetary Nebula Exposed to Stellar Radiation and Stellar Wind from the Central Star

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A model for a nebula exposed to the radiation and stellar wind from the central star has been examined.

T Tauri stars commonly have disks and stellar wind, though we have no theoretical model on nebular thermal structure under the wind.

The aims of this paper are to propose a theoretical nebula model, to perform mathematical analysis on the geometrical structure and temperature distribution of a passive nebula.

Its geometrical surface is determined by the dynamical pressure of the stellar wind.

The nebular surface is assumed to be a black body surface, heated by the incident stellar photon flux.

We obtain temperature from the equation of energy balance between the stellar radiation upon this nebular surface and the black body radiation from it.

The temperature distribution in passive disks is insensitive to the wind strength.

The temperature distribution is almost identical even if the wind strength changes by 5 orders of magnitude.

The nebula temperature is not expressed by a simple power law function of the distance from the central star.

This is an important difference between our results and the previous works.

Since the nebula surrounding a T Tauri star is influenced by stellar wind, our model may be more appropriate than any other simple single power law temperature for passive protoplanetary nebulae.