Falle,S.A.E.G.: 1975, Astron. Astrophys. 43, 323.
Lepp, S., and Shull, J.M.: 1983, Astrophys. J. 270, 578.
Nadeau, D., Geballe, T.R., and Neugebauer, G.: 1982, Astrophys. J. 253, 154.
Weaver, R., McGray, R., Castor, J., Shapiro, P., and Moore, R.: 1977, Astrophys. J. 218, 377.

EQUILIBRIUM AND COLLAPSE OF ROTATING ISOTHERMAL CLOUDS

S. Narita
Dept. of Electronics, Doshisha U., Kyoto 602, Japan
M. Kiguchi
Inst. of Science and Tech., Kinki U., Osaka 573, Japan
S.M. Miyama
Dept. of Physics, Kyoto U., Kyoto 606, Japan
C. Hayashi
Momoyama Yogoro-cho 1, Fushimi-ku, Kyoto 612, Japan

We have performed numerical calculations for both static and dynamic structures of molecular clouds in which stars would be formed. The assumption in our calculations is that a cloud, which is embedded in an external hot and tenuous uniform medium, is isothermal and axisymmetric.

According to our results, the equilibrium structures of rotating isothermal clouds have the following characteristic properties. A cloud cannot be stable but begins to collapse if the central density exceeds about 800 at most (in units of the density at the surface of a cloud, the sound speed in a cloud, and the gravitational constant). With an increase in the angular momentum J, the mass of a cloud M increases and the flatness becomes larger, but J/M^2 remains around 0.2.

When the angular momentum distribution is chosen to be the same as that of a rigidly rotating uniform sphere, we obtain the maximum mass ($M \sim 35$) for the sequences of stable clouds, where the flatness is about 16 and the cloud gives rise to ring-like fragmentation.

We have found through some numerical simulations together with analytic investigations that the structure of a collapsing cloud is closely similar to that of a cloud in equilibrium, which has a rigidly rotating uniform core, an inner envelope with the density profile $\rho \propto \varpi^{-2}$, and with the angular velocity profile $\omega \propto \varpi^{-1}$, where ϖ is the distance from the rotation axis, and an outer envelope subject to initial and outter boundary conditions.

This dynamic structure indicates that an axisymmetric isothermal cloud undergoes runaway collapse until the core becomes opaque, and that no hierarchical fragmentation occurs.