THE MAGNETIC FIELD IN HIGHLY DENSE MOLECULAR CLOUDS

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General forms of the B-ρ relation are investigated in both the isothermal and the non-isothermal regions. The magnetic flux dissipation either by ambipolar diffusion or by Ohmic dissipation has been restudied. The rates of heating due to the magnetic dissipation processes have been calculated in comparison with the rate of compressional heating.

The magnetic field strength is derived as a function of flux/mass ratio,mass,density and geometry of the isothermal cloud. In the non-isothermal region,the temperature is added to the above mentioned variables. The geometry defines if the cloud is a spherical or a flattened one. The magnetic field relations derived in the non-isothermal region can be used to determine the values of the magnetic feild in the later stages of cloud contraction till reaching the stellar densities. The effect of rotation has not been taken into consideration.

It has been found(under the assumption that the ions and the electrons are chemically adsorbed on the grain surface) that the magnetic flux starts to dissipate via ambipolar diffusion at neutral densities of $n>3\times10^{9}$ cm^{-3} . Ambipolar diffusion continue effective untill reaching densities of $n>10^{11}$ cm^{-3} ,where Ohmic dissipation dominates. Assuming that the adsorption energy of electrons on grain surface is one eV and the temperature of the grain increases instantaneously as the temperature of the cloud material,the electrons evaporate from the grain surface at $n>10^{13}$ cm^{-3}. While the electrons evaporate,the ions are still adsorbed on the grain surface. Consequently,the magnetic flux dissipation returns to be influenced by ambipolar diffusion.

The rates of heating by both Ohmic dissipation,Γ1,and ambipolar diffusion,Γ2,are found to be smaller than the rate of compressional heating,Γ3,in case of magnetic flux dissipation. Otherwise(assuming that the magnetic field is frozen in medium),Γ3 is smaller than both Γ1 and Γ2. The most important factor affecting either Γ1 or Γ2 is the decrease of the flux/mass ratio. The above results of heating were found in the non-isothermal region.

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