STUDIES OF THE DYNAMICS OF MAGNETIZED GRAVITATING DISK

by

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Dedicated to

All those upon whose smiles

my own happiness is fully dependent

Certificate

I hereby declare that the work presented in this thesis has not formed the basis for the award of any degree or diploma by any University or Institution.

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Certified by:

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Thesis Supervisor

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Abstract of the Thesis

The origin and maintenance of the galactic magnetic field have been studied in this thesis.Bisymmetric spirals are the most common feature of the magnetic field structure in the galaxies though some of them possess ring structure also. Even though dynamo theory explains the many observational feature of the magnetic field of the galaxy, it remains unsatisfactory, on many counts.

Evolution of galactic magnetic field is related with the dynamics of the galactic plasma disk and hence it is necessary to find the "mechanism" which would contribute to the growth of the magnetic field in the galactic disk.We have studied here one such mechanism, which arises as a result of the non-uniformity of the matter density in the magnetized plasma disk. The inverted gradient of density column supported by plasma against the gravity is quite effective for the energy needed for the growth of the magnetic field. It is Rayleigh-Taylor instability which is responsible for the amplification of the magnetic field.It is found that such a process could amplify the magnetic field of the disk with the growth rates which depends on the density gradient of the matter etc.

A more complete theory of the bisymmetric spiral field, as the allowed eigen-functions of a gravitating magnetized disk would require a self-consistent solution as an eigenvalue problem with proper boundary condition.We have

carried out such a study for a thin magnetized plasma disk with rigid rotation (which is the only permissible solution of the induction equation in the infinite conductivity limit). It is found that bisymmetric spirals appear as the allowed eigenmodes of the disks eventhough the disk is rigidly rotating which has to be contrasted with the differential rotations required for the dynamo action in the disk.