ROSSBY WAVES IN "SHALLOW WATER" MAGNETOHYDRODYNAMICS

T.V. Zaqarashvili[1,2], R. Oliver[1], J.L. Ballester[1] and B.M. Shergelashvili[2,3]

[1] *Departament de Física, Universitat de les Illes Balears, E-07122 Palma de Mallorca, Spain;*
[2] *Georgian National Astrophysical Observatory (Abastumani Astrophysical Observatory), Kazbegi Ave. 2a, Tbilisi 0160, Georgia;*
[3] *Instituut voor Theoretische Fysica, K.U. Leuven, Celestijnenlaan 200 D, B-3001 Leuven, Belgium*

The influence of a toroidal magnetic field on the dynamics of Rossby waves in a thin layer of ideal conductive fluid on a rotating sphere is studied in the "shallow water" magnetohydrodynamic approximation for the first time. Dispersion relations for magnetic Rossby waves are derived analytically in Cartesian and spherical coordinates. It is shown that the magnetic field causes the splitting of low order (long wavelength) Rossby waves into two different modes, here denoted fast and slow *magnetic Rossby waves*. The high frequency mode (the fast magnetic Rossby mode) corresponds to an ordinary hydrodynamic Rossby wave slightly modified by the magnetic field, while the low frequency mode (the slow magnetic Rossby mode) has new and interesting properties since its frequency is significantly smaller than that of the same harmonics of pure Rossby and Alfvén waves.