Hall Effect in Neutron Star Crusts

Konstantinos Gourgouliatos^{*1}

¹McGill University – 740 Dr Penfield Avenue, Montréal QC, Canada

Abstract

The crust of Neutron Stars can be approximated by a highly conducting solid crystal lattice. The evolution of the magnetic field in the crust is mediated through Hall effect, namely the electric current is carried by the free electrons of the lattice and the magnetic field lines are advected by the electron fluid. I shall present equilibrium solutions, which may be the end points of evolution through Hall effect, such solutions contain both toroidal and poloidal field and bear some similarities to known MHD equilibrium magnetic fields. I shall also present the results of a time-dependent evolution code which shows the effect Hall drift has in the large-scale evolution of the magnetic field. It is shown that an MHD equilibrium field of the progenitor evolves due to Hall drift upon the formation of the solid crust. Such evolution can be related to magnetar activity.