Hall drift in the stratified crust of neutron stars

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ABSTRACT: We present a numerical model of magnetic field evolution in the crusts of neutron stars, under the influence of Hall drift and Ohmic decay, and including also variations in density across the depth of the crust. For purely toroidal fields we obtain results in perfect agreement with previous analytic models, according to which the field develops current sheets, and thereby decays on the fast Hall timescale rather than the slow Ohmic timescale. If we include poloidal fields though, the evolution is very different, and no longer decays on the fast timescale. The sign of the initial fields is also very important, and leads to a concentration of flux at either the magnetic poles or the equator, which may have observational consequences.