



Fluctuations of electrical conductivity: a new source for astrophysical magnetic fields

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We consider the generation of magnetic field by the flow of a fluid for which the electrical conductivity is nonuniform. We calculate the properties of this effect both analytically and numerically, and find a new amplification mechanism leading to dynamo action for flows much simpler than those considered so far. In particular, the fluctuations of the electrical conductivity provide a way to bypass anti-dynamo theorems. For astrophysical objects, we show through three-dimensional global numerical simulations that the temperature-driven fluctuations of the electrical conductivity can amplify an otherwise decaying large scale equatorial dipolar field. This effect could play a role for the generation of the unusually tilted magnetic field of the iced giants Neptune and Uranus.