

Electric dipoles on magnetic monopoles in spin ice

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Close connection of electricity and magnetism is one of the cornerstones of modern physics. This connection plays crucial role both from the fundamental point of view and in practical applications, including recent advance in spintronics and in the study and development of multiferroic materials.

A new breakthrough was the recent proposal of Castelnovo, Moessner and Sondhi that in spin ice systems one can model the magnetic monopoles – the objects displaying the properties of isolated magnetic charges.

This proposal gave rise to the flurry of activity, in which, in particular, the close analogy between electric and magnetic phenomena (“magnetricity”) was invoked and used to interpret the observed phenomena. I show that this analogy goes even further: I demonstrate that whereas electrons have electric charge and spins, i.e. magnetic dipoles, every magnetic monopole in spin ice should have an electric dipole attached to it.

This opens new possibility to study and to control such monopoles .