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TÉMA

Controlling magnetism at the nanoscale with surface charge manipulation

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Understanding the nature of magnetic interactions in ultra-small magnetic ensembles and their intrinsic properties is vital for synthesizing functional magnetic nanostructures. One of the major endeavors is to search for nanoscale materials with high magnetic anisotropy. At the nanoscale, the latter can be voluntarily tailored by careful choice of the constituent atoms, geometry,[1] or by functionalizing metallic surfaces with alkali metal atoms.[2] Moreover, the continuous reduction of stable magnetic units to smaller length scales is inspiring that motivates the efforts for a suitable means of controlling magnetism at the atomic scale. We have employed external electric field and surface charging techniques which is a flavor of magneto-electric coupling that relies on the manipulation of charge carriers.[1-4] Such techniques allow dynamic and local control over magnetic properties that can be used as a way to tailor exchange interaction or anisotropies of wires and layered systems. Remarkably, a modest charge injection can switch the easy-axis of magnetization of ultra-thin FePt films by 90 degrees.[1] Similarly, the relative interlayer magnetic order in metallic multilayers can be reversed, from parallel to anti-parallel, by surface charging or ionic doping.[2] The local changes in the magnetic properties are explained by the analysis on the variation of the electronic structure of the interface layers or atoms,[1,4] Even more, we reveal the spin dynamics of Fe clusters on metallic surface that are triggered by magnetic pulse and their relative magnetic order is tuned.

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