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Electrically driven magnetism on a Pd thin film YANG SUN, JOHN BURTON, EVGENY TSYMBAL, University of Nebraska at Lincoln — Using first-principles density functional calculations we demonstrate that ferromagnetism can be induced and modulated on an otherwise paramagnetic Pd metal thin-film surface through application of an external electric field [1]. As free charges are either accumulated or depleted at the Pd surface to screen the applied electric field there is a corresponding change in the surface density of states. This change can be made sufficient for the Fermi-level density of states to satisfy the Stoner criterion, driving a transition locally at the surface from a paramagnetic state to an itinerant ferromagnetic state above a critical applied electric field, E_c. Furthermore, due to the second-order nature of this transition, the surface magnetization of the ferromagnetic state just above the transition exhibits a substantial dependence on electric field, as the result of an enhanced magnetoelectric susceptibility. A linearized Stoner model explains the occurrence of the itinerant ferromagnetism and demonstrates that the magnetic moment on the Pd surface follows a square-root variation with electric field, $m \propto (E - E_c)^{1/2}$, consistent with our first-principles calculations. Thus, the predicted magnetoelectric effect manifests itself as a critical phenomenon and reveals the magnetoelectric susceptibility strikingly different from that previously known.

[1] Y. Sun, et al. arXiv:911.2678

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