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Silicon Field-Effect Spin Lattices for Magnetism and Superconductivity Tests MARK S. MILLER, U. of Utah, JUN YANG, JUSTIN JACKSON, Weber State U., DANIEL WATROUS, DIVESH KAPOOR, U. of Utah — Field-effect silicon spin lattices, two-dimensional structures patterned at the ten-nanometer scale, may work well for implementing strongly-coupled electronic systems. These metal-oxide-semiconductor devices have a subtly structured silicon-oxide interface that can produce substantial electronic structure effects. Comparing strong-coupling length and energy scales for semiconductors shows silicon a reasonable choice, with scales of 15.0 nm and 8.8 meV. The systems considered here for emulation with spin lattices include Lieb's ferromagnetic (*PRL* 1989) and Mattis' high-T_c superconductivity (*Int. J. Mod. Phys. B* 2006) Hubbard models. Effective mass calculations for independent electrons in spin lattice devices with antidot geometries gave energy bands for fitting to bands from the Hubbard model with interactions turned off. The onsite tight-binding electron repulsion energy was estimated with the Coulomb charging energy of a spin lattice site. The calculations examined lattices with either electric field-dependent or -independent hopping parameters. For circular antidots on a square lattice, the optimal period-to-diameter ratio of $l/d \approx 2.5$ maximizes Mattis' coupling parameter, giving 1.7 meV and 15 meV for diameters $d = 10$ and 3 nm. Technology issues will be discussed, including the results of ongoing fabrication efforts.

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