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Spin chains and electron transfer at stepped silicon surfaces STEVEN ERWIN, Naval Research Laboratory, JULIAN AULBACH, RALPH CLAESSEN, JOERG SCHAEFER, Universitaet Wuerzburg — Stepped silicon surfaces oriented between Si(111) and Si(001) show unusual behavior when submonolayer amounts of gold are adsorbed: they self-assemble to form arrays of steps with virtually perfect structural order. Known examples include Si(553), Si(557), and Si(775). For the first two of these there is, in addition, strong theoretical and experimental evidence that the silicon step edges are spin polarized, raising the possibility of a magnetically ordered ground state at a silicon surface. The situation is different, however, for Si(775): theory and experiment both show that spin polarization does not occur. Here we use density-functional theory and scanning tunneling microscopy to develop a physically transparent picture explaining the formation of these 'spin chains' on the family of Si(hhk)-Au surfaces. Specifically, we explain why spin chains form on particular silicon (hhk) orientations but not on others. Finally, we use this understanding to propose strategies for using surface chemistry to control the formation or suppression of spin chains on Si(hhk)-Au surfaces.

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