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Controlled placement of Mn acceptors in GaAs (110) surfaces: Crystal orientation and spacing dependences for interactions between Mn acceptors[1] DALE KITCHEN, ANTHONY RICHARDELLA, ALI YAZDANI, Princeton University — We report a controlled incorporation process substituting single Mn atoms into acceptor sites in GaAs (110) surfaces using a low temperature scanning tunneling microscope (STM). The incorporation process brings a Ga atom to the surface as an adsorbate loosely bound to the Mn that has replaced it in the lattice. Displacement of a Ga atom away from the substituted Mn via STM manipulation isolates the Mn atom in the surface layer acceptor configuration. In this acceptor configuration Mn atoms give rise to strong in-gap energy levels, with unusual and detailed spatial structure of highly anisotropic character. Modifications to this in-gap resonance level and its structure occur under controlled placement of two closely spaced Mn acceptors, revealing a striking dependence upon crystal orientation and spacing. For certain pair orientations, strong bonding/antibonding-like interactions split the in-gap level of the single Mn state, while the in-gap levels of other pairs of comparable spacing but different orientation are degenerate with the isolated Mn state.

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