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One-dimensional physics in transition-metal nanowires[1] JUNICHI OKAMOTO, ANDREW MILLIS, NADER ZAKI, CHRIS MARIANETTI, Columbia University — One atom wide transition-metal nanowires can now be fabricated on Cu step edges. We present a theoretical study of the electronic properties of such systems. While the systems fall within the broad class of Luttinger liquids, about which much is known, characteristic features of transition metals including orbital degeneracy and interactions which favor locally high-spin configurations lead to new physics. Density functional calculations indicate that Co nanowires on Cu surfaces are half metals and are not electronically isolated from the substrate material. The multi-orbital and local high-spin physics are elucidated by Hartree-Fock approximations and bosonization calculations of the multi-orbital Hubbard model.

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Junichi Okamoto
Columbia University

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