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Electronic Effects in the Length Distribution of Si(553)-Au Chains[1] JASON CRAIN, MARK STILES, JOSEPH STROSCIO, DANIEL PIERCE, Electron Physics Group, NIST — The electronic structure of nanostructures directly impacts their energetics. For example, the confinement of electronic states determines preferred sizes for clusters and thin films. In the present study we investigate the effects of the electronic structure on the self-assembly of Si(553)-Au atomic chains, which are broken into finite-size segments by defects [1,2]. Chains are first fabricated by depositing gold on stepped silicon surfaces [3]. Scanning tunneling microscopy measures the distribution of chain lengths and the correlation between defects separating chains. The distribution of chain lengths reveals incommensurate oscillations that are linked to the electronic scattering vectors at the Fermi surface of the surface states. The pairwise correlation function between defects shows long-range correlations that extend beyond nearest-neighbor defects, indicating coupling between chains. [1] J. N. Crain, A. Kirakosian, K. N. Altmann, C. Bromberger, S. C. Erwin, J. L. McChesney, J. L. Lin, and F. J. Himpsel, Phys. Rev. Lett., 90, 176805 (2003). [2] J. N. Crain and D. T. Pierce, Science, 307, 703 (2005). [3] J. N. Crain, J. L. McChesney, F. Zheng, M. C. Gallagher, P. C. Snijders, M. Bissen, C. Gundelach, S. C. Erwin, and F. J. Himpsel, Phys. Rev. B, 69, 125401 (2004).

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