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Competing periodicities in fractionally filled quasi-1D bands
P.C. SNIJDERS, Kavli Institute of Nanoscience, S. ROGGE, Kavli Institute of Nanoscience, Delft, The Netherlands, H.H. WEITERING, University of Tennessee, Knoxville, and Oak Ridge National Laboratory, USA — We present a variable temperature Scanning Tunneling Microscopy and Spectroscopy (STM and STS) study of the Si(553)-Au atomic chain reconstruction. This quasi one-dimensional (1D) system undergoes at least two charge density wave (CDW) transitions at low temperature, which can be attributed to electronic instabilities in the fractionally-filled 1D bands of the high-symmetry phase. Upon cooling, Si(553)-Au first undergoes a single-band Peierls distortion, resulting in period doubling along the imaged chains. This Peierls state is ultimately overcome by a competing tripleperiod CDW, which in turn is accompanied by a $\times 2$ periodicity in between the chains. These locked-in periodicities indicate small charge transfer between the nearly half-filled and quarter-filled 1D bands. The mobility of atomic scale dislocations in the $\times 3$ CDW state indicates the possibility of manipulating phase solitons carrying a (spin,charge) of $(1/2,\pm e/3)$ or $(0,\pm 2e/3)$.

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