Abstract Submitted
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Transient doping in atomic chains – a case study in time-resolved STM[1] PAUL SNIJDERS, Oak Ridge National Laboratory, and The University of Tennessee, Knoxville, STEFAN POLEI, University of Rostock, Germany, STEVE ERWIN, Naval Research Laboratory, Washington D.C., FRANZ HIMPSEL, University of Wisconsin, Madison, KARL-HEINZ MEIWES-BROER, INGO BARKE, University of Rostock, Germany — Doping one-dimensional (1D) systems is notoriously difficult due to the structural disorder created by the dopants. The Si(553)-Au surface features an array of step edges with 1D chains of dangling bonds. These chains have a 1x3 ordered ground state [1]. Using a scanning tunneling microscope we inject electrons from the tip into these step-edge chains and we observe that the periodicity of the atomic chains changes from the 1x3 ordered ground state to a 1x2 ordered excited state with increasing tunneling current. The threshold current for this transition is reduced at lower temperatures. In conjunction with first principles density-functional calculations we conclude that the 1x2 phase is created by transient doping of the atom chains [2]. Random telegraph fluctuations between two levels of the tunneling current provide direct access to the dynamics of the phase transition, revealing a monostable state, and lifetimes in the millisecond range. Our method provides a possible avenue to map out a doping-dependent phase diagram in cases where conventional impurity doping is problematic.

[1] S.C. Erwin, F.J. Himpsel, Nat. Comm. 1:58 (2010).
[2] S. Polei et al., PRL 111, 156801 (2013).

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