Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Low-Temperature Nonequilibrium Transport through Multi-pathway Single-Molecule-Transistor Systems as Which-way Effect Detector HAIZHOU LU, ZUO-ZI CHEN, RONG LU, Center for Advanced Study, Tsinghua University, Beijing 100084, China, BANG-FEN ZHU, Center for Advanced Study, Tsinghua University, Beijing 100084, China and Department of Physics, Tsinghua University, Beijing 100084, China — We theoretically investigate the electronic transport through an AB-ring with a quantum dot (QD) embeded and a double-quantum- dot (DQD) interferometer. The QDs in both structures are coupled to a vibrational mode by electron- phonon interaction. With the help of Nonequilibrium Green function formalism and an improved independent boson model approximation, low-temperature bias-induced phonon-assisted sidebands are resolved. Electrons can tunnel via the phonon sidebands, pure electronic levels, or directly from one lead to the other. For DQD interferometer, electrons tunneling via two dots must emit the same number of the identical phonons to interfere with each other. Emitting different numbers of phonons would make the two pathways distinguishable, thus destroys the coherence between two pathways. Therefore this system could act as an intrinsic which-way effect detector in energy space. For the AB-ring model, the which-way effect does not apply since the direct lead-lead tunneling is assumed to be independent of energy. As a result, all phonon side peaks show flux-dependent Fano lineshapes.

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Date submitted: 20 Nov 2006 Electronic form version 1.4