Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Transmission phase shift across a Kondo correlated quantum dot
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— We report on measurements of the transmission phase across a quantum dot embedded in an original two-path interferometer both in the strong and weak Kondo regime. The Kondo effect is a well known many-body phenomenon, which is characterized by a single energy scale, the Kondo temperature $T_{\rm K}$. In the strong Kondo regime at low temperatures ($T/T_{\rm K}$ <1) we found that the transmission phase is locked to $\pi/2$ in the Kondo valley when the single level spacing $\delta$is significantly larger than the level broadening Γ. When Γ is relatively large, on the other hand, the phase smoothly shifts by π across two peaks on both ends of the Kondo valley without showing any plateau. As the temperature is increased exceeding $T_{\rm K}$, the Kondo correlation becomes lifted and then the phase shift looks similar to that in the Coulomb blockade regime, where the phase evolves π across a Coulomb peak followed by a π-phase lapse in the Coulomb valley. In such a weak Kondo regime ($T/T_{\rm K}$ >1) we observed asymmetric phase evolution about the valley center, which is linked to the orbital parity relation between the levels of interest.

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Date submitted: 28 Nov 2012 Electronic form version 1.4