Persistent currents in mesoscopic rings with a quantum dot

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Using the Anderson model in the Kondo regime, and an interpolative perturbation scheme for the impurity spectral density, we calculate the persistent current j in a ring with an embedded quantum dot (QD) as a function of the Aharonov-Bohm flux Φ for different ring length L, temperature T and broadening of the conduction states δ. Comparison with exact diagonalization results for small L, and renormalization group results for large L, shows that the method is accurate enough to describe $j(\Phi)$ for all L/ξ, where ξ is the Kondo screening length. The universal dependence of Lj with L/ξ is displayed. For $T = \delta = 0$ and $L \gg \xi$, Lj tends to the value for a non interacting ideal ring, while it is suppressed for a side coupled QD. For any L/ξ, Lj is also suppressed when either T or δ increase above a fraction of the level spacing which depends on Φ.