Andreev reflection and Josephson current through a Kondo Y-junction

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We study low-temperature transport through a single quantum dot (QD) connected to three terminals, consisting of two superconducting (SC) leads and one additional normal lead. This system shows interesting behavior caused by an interplay between Josephson, Andreev and Kondo physics. The low-energy excitations of this system can be described by a local Fermi liquid theory for the renormalized Bogoliubov particles. We calculate the renormalized parameters using the Wilson numerical renormalization group approach. The Kondo temperature and the residual interaction between the renormalized Bogoliubov particles depend sensitively on the Josephson phase ϕ at the crossover region between the local Cooper-pairing singlet and the Kondo singlet states. This crossover reflects the quantum phase transition between a non-magnetic singlet and magnetic double states, which takes place in the case where the addition normal lead is disconnected. We will also discuss the results for the Josephson current and the DC conductance due to the Andreev reflection.