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Electrical control of Kondo effect and superconducting transport in a sidegated InAs quantum dot Josephson junction YASUSHI KANAI, RUSSELL DEACON, AKIRA OIWA, KATUHARU YOSHIDA, The University of Tokyo, KENJI SHIBATA, KAZUHIKO HIRAKAWA, SEIGO TARUCHA — Transport through a quantum dot Josephson junction exhibits the novel interplay between the superconductivity and Kondo screening. The important energy scales for the interaction between Kondo effect and superconductivity are captured in the scaling parameter $t_K = k_B T_K/\Delta$ determined by the superconducting gap energy (Δ) and Kondo temperature (T_K). Here, we demonstrate that an additional sidegate electrode placed laterally to the InAs QD can tune smoothly t_K, because it imposes an additional anisotropic electrostatic potential on the QD. Using the sidegate we study the non-dissipative and dissipative transport through the QD Josephson junction as a function of t_K. When t_K is tuned through unity we find a drastic change in the Josephson current as shown. We measure a 'switching current' I_{sw} defined by the current value at the maximum differential resistance instead of a critical current. For $t_K >> 1$, I_{sw} is large while for $t_K << 1$ I_{sw} is strongly suppressed. These results suggest that the junction is tuned from a 0-junction in which the supercurrent is enhanced by Kondo correlations to a π-junction in which the magnetic moment is unscreened and switching current is suppressed. We find that the transition occurs at $t_K \sim 1.1$.

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