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Observation of Josephson junction behavior in an individual superconducting $NbSe_2$ nanowire[1] ZHIXIAN ZHOU, R. JIN, GYULA ERES, D. MANDRUS, Materials Science and Technology Division,Oak Ridge National Laboratory, P. SCHLOTTMANN, Department of Physics, Florida State University, Y.S. HOR, Z.L. XIAO, J.F. MITCHELL, Materials Science Division, Argonne National Laboratory — Resistance and current-voltage characteristics of an individual superconducting $NbSe_2$ nanowire of 75 nm diameter were investigated employing four-probe transport measurements. With the absence of the dissipative motion of vortices, we find that the critical current is limited by a single asymmetric Josephson junction with unequal energy gaps across the junction and that their temperature variation is in excellent agreement with the BCS theory. The difference in the magnitude of the superconducting gap can be attributed to the existence of multiple Fermi surface sheets possessing different electronic structure and electron-phonon interactions. In addition, the temperature dependence of the critical current can be well described by the Ambegaokar-Baratoff relation.

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