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Coherent quantum transport in hybrid Nb-InGaAs-Nb Josephson junctions KAVEH DELFANAZARI, Electrical Engineering Division, and Cavendish Laboratory, University of Cambridge, UK, R. PUDDY, P. MA, M. CAO, T. YI, University of Cambridge, UK, Y. GUL, University College London (UCL), UK, I. FARRER, University of Sheffield, UK, D. RITCHIE, H. JOYCE, M. KELLY, C. SMITH, University of Cambridge, UK — Because of the recently reported detection of Majorana fermions states at the superconductor-semiconductor (S-Sm) interface in InAs nanowire devices, the study of hybrid structures has received renewed interest. In this paper we present experimental results on proximity induced superconductivity in a high-mobility two-dimensional electron gas in InGaAs heterostructures. Eight symmetric S-Sm-S Josephson junctions were fabricated on a single InGaAs chip and each junction was measured individually using a lock-in measurement technique. The superconducting electrodes were made of Niobium (Nb). The measurements were carried out in a dilution fridge with a base temperature of 40 mK, and the quantum transport of junctions were measured below 800 mK. Owing to Andreev reflections at the S-Sm interfaces, the differential resistance (dV/dI) versus V curve shows the well-known subharmonic energy gap structure (SGS) at $V = 2\Delta_{\mathrm{Nb}}/ne$. The SGS features suppressed significantly with increasing temperature and magnetic field, leading to a shift of the SGSs toward zero bias. Our result paves the way for development of highly transparent hybrid S-Sm-S junctions and coherent circuits for quantum devices capable of performing quantum logic and processing functions.

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