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Graphene/Lead (Pb)-based Cooper -pair splitter IVAN BORZENETS, YUYA SHIMAZAKI, University of Tokyo, GARETH JONES, SAVERIO RUSSO, University of Exeter, MICHIHISA YAMAMOTO, SEIGO TARUCHA, University of Tokyo — We have fabricated a Cooper-pair splitter device based on a superconductor- two normal leads, "Y" shaped junction with graphene as the base material. (Compared to nanowire-based devices, the two dimensional nature of graphene allows for the normal leads to be placed arbitrarily close together and in a non-parallel arrangement.) The superconducting lead is created by contacting graphene with lead (Pb), thus inducing a supercurrent via the proximity effect. The normal metal leads are patterned into quantum dots by etching nano-constrictions with self-aligned side gates. Quantum dots strongly suppress two electron processes, allowing only one electron to pass at a time. Thus, the Cooper-pair splitting efficiency is enhanced as the split electrons must necessarily tunnel through different quantum dots. Using a DC measurement we have demonstrated enhanced currents though both normal leads when both quantum dots are in resonance and the input lead is in the superconducting regime: demonstrating Cooper-pair splitting. (This is contrary to the classical regime of currents though a three resistor junction.) Shot noise measurements would demonstrate that the split electrons tunnel at the same time. Demonstrating that the split electrons have opposite spin would show that such a device could be used as a source of quantum entangled electrons.

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