

---

**Anindya Das**

Indian Institute of Science, India

[dasanindy@gmail.com](mailto:dasanindy@gmail.com)

---

## **The Andreev reflection at the junction of graphene quantum Hall state and superconductor**

Tremendous effort is currently underway toward generating and manipulating Majorana fermions by coupling a superconductor (SC) either to a topological insulator or to a semiconductor with strong spin orbit coupling. The coupling of a quantum Hall (QH) state and a superconductor (SC) has been proposed as a novel route for creating even more exotic topological entities, such as non-abelian Majorana, parafermion or Fibonacci particles. As a step toward that goal, we demonstrate in this letter Andreev reflection (AR) at the junction of a QH state in a single layer graphene (SLG) and a two dimensional (2D) NbSe<sub>2</sub> superconductor. This system allows us to study Andreev effect up to magnetic fields as high as  $B = 10\text{T}$  when graphene consists of well resolved Landau levels. We see characteristic signatures of Andreev reflection, such as: enhanced conductance inside the superconducting gap; oscillations in the conductance as a function of the magnetic field or the back gate voltage; and also an anomalous finite-temperature peak located precisely at the Dirac point, which provides a compelling evidence for inter-band Andreev reflection. Our observations are well supported by detailed numerical simulations, which offer additional insight into the role of the edge states in coupling superconductor and QH state. This study paves the way for investigating analogous Andreev reflection in a fractional quantum Hall system coupled to a superconductor.