Superconducting contacts to mono- and few-layer semiconductor crystals

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Abstract

Superconductor-Semiconductor hybrid devices have proven most fruitful for fundamental research and applications, such as gate tunable qubits [1], thermoelectrics [2] and exotic quantum states [3]. Two-dimensional materials, such as transition metal dichalcogenides (TMDCs), are promising candidates for spin- and valleytronics applications, as well as a platform to study topological phenomena. Here, we demonstrate hybrid devices based on monolayer MoS_2, a semiconducting TMDC, contacted by vertical interconnect access (VIA) [4] superconducting contacts [5]. The transport characteristics of the devices exhibit a superconducting energy gap, which we probe as a function of magnetic field and temperature [5]. In addition, we discuss zero-bias and finite-bias conductance peaks and Fabry-Pérot-type resonances, and compare MoS_2 and InSe devices fabricated with the same method.

References

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Figures

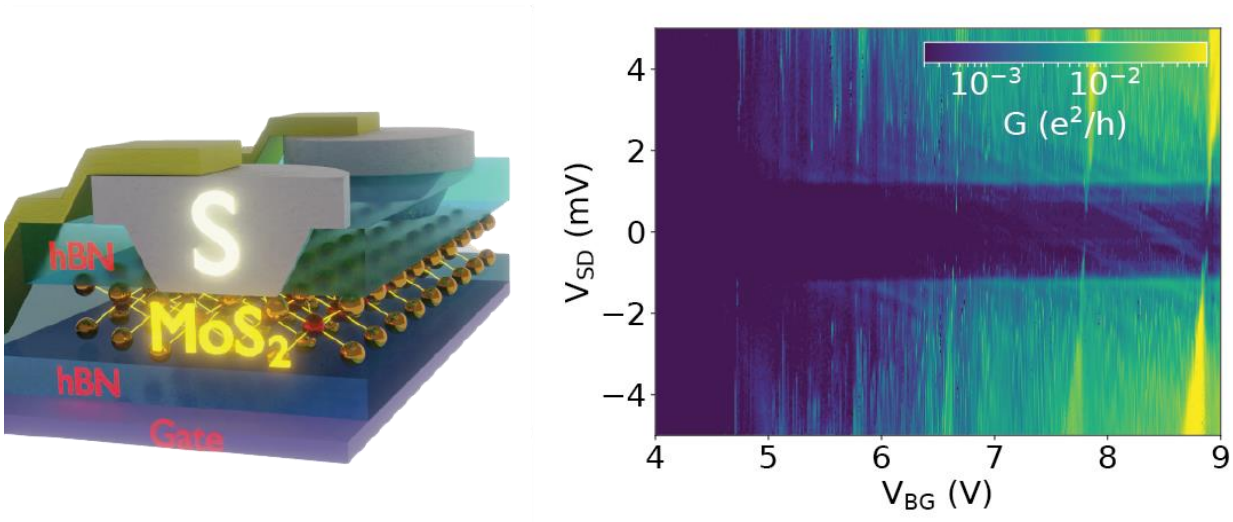

Figure 1: Left: Illustration of superconducting VIA contacts in an MoS_2 device. Right: Differential conductance between two VIA contacts to a monolayer of MoS_2 plotted as function of the applied bias and gate voltage.