Towards perfect quantum sensing: gate-controlled bi-superconducting quantum interference devices.

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Ultra-high precision magnetic field sensors constructed from superconductors are of significant commercial and scientific importance, with applications spanning remote sensing, medical imaging, and may potentially play a central role in the technology necessary for establishing an Earth-Mars communication link. Their operation and performance are currently far from being optimised. The bi-superconducting quantum interference device (bi-SQUID) is a promising device design that was initially theorised to exhibit highly desirable performance characteristics which greatly surpass that of all other existing devices in the field, but such behaviour was unable to be physically realised in practice [1]. A recently conceived method to tune the device characteristics by way of applying an electrostatic gate voltage has been making waves as a means to further improve the device [2]. We discuss the recent experimental results obtained [1] alongside the latest modelling efforts for these devices, and comment on the current progress in understanding the microscopic mechanism behind this effect.

[1] G. De Simoni et al, *https://journals.aps.org/prapplied/accepted/b607bA95A521cf0f42519404d8eebaa0c947cf9aa.*

[2] G.C Tettamanzi, I. Nakone, F. Giazotto and P. Atanackovic, “A quantum magnetic field receiving device”, Australian Provisional Patent Application 2021903616 (2021).