Coherent coupling between magnons and photons using superconducting resonators at the two-dimensional limit

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Project Summary:

The electronic properties of materials can drastically change as a function of their dimensionality. The discovery of graphene in 2004 [1] is an iconic example, establishing new research fields of two dimensional materials that have weakly-bonded vdW interaction between adjacent monolayers. The weak bonding makes it possible to mechanically exfoliate them while maintaining thermodynamically stable individual layers, even down to the monolayer limit.

In this project we will develop the quantum mechanical hybridised states of magnons, the excitation quanta of magnetically-ordered systems, and photons in superconducting resonators. We recently developed such hybridisation states using vdW magnets and on-chip resonators [2]. This studentship project will build on this recent development and achieve the robust coupling state with magnons in a monolayer magnet. We will unveil the spin dynamics of monolayer magnets using this coupled state and explore any applications for quantum technologies such as frequency transduction.

The UCL Kurebayashi group is a dynamic research group (https://www.ucl.ac.uk/spintronics) with multiple research interests (spintronics, neuromorphic computing and quantum technologies). This particular project will be conducted in collaboration with Prof. John Morton's group at UCL.

[1] Novoselov et al., Science 306, 666 (2004).

[2] Zollitsch et al., Nature Comm. 14, 2619 (2023)