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POS-G72 – Multi-frequency torque magnetometry: contribution of the Einstein-de Haas effect, and direct detection of overlapping magnetic and mechanical resonance modes

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High-finesse optical nanocavities coupled with nanomechanical torque sensors have enabled highly sensitive and broadband readout of magnetic torques, from timescales involving quasi-static hysteresis response to radio-frequency magnetic susceptibility [1-3]. The extension of torque magnetometry to higher mechanical frequencies will grant further access to spin dynamics, including mechanical investigations of spin-lattice relaxation times.

For nanomechanical torque magnetometry measurements into radio frequencies, the contribution of the Einstein-de Haas (EdH) effect can become comparable to, and even exceed, the conventional magnetic torque (cross-product of magnetic moment and applied field) signal [4]. Extending sensitive optomechanical detection across a ladder of higher-order mechanical modes is a natural way to extract further information, through examination of the relative scaling of EdH and cross-product torques.

Sufficiently high-order mechanical modes have application to co-resonant detection of magnetic resonances. Magnetic vortex resonances intersecting the mechanical resonance spectrum will be described, and allow for the observation of dynamic vortex core interactions with magnetic inhomogeneities.

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