Attractive force on atoms due to blackbody radiation

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Atom interferometry has proven within the last decades its surprising versatility to sense with high precision tiniest forces. In this talk I will present our recent work, using an optical cavity enhanced atom interferometer to sense for an on the first-place counterintuitive inertial property of blackbody radiation[1].

Blackbody (thermal) radiation is emitted by objects at finite temperature with an outward energy-momentum flow, which exerts an outward radiation pressure. At room temperature e. g. a cesium atom scatters on average less than one of these blackbody radiation photons every 10^8 years. Thus, it is generally assumed that any scattering force exerted on atoms by such radiation is negligible. However, particles also interact coherently with the thermal electromagnetic field[2] and this leads to a surprisingly strong force acting in the opposite direction of the radiation pressure. Using atom interferometry, we find that this force scales with the temperature of the heated source object (293 – 450 K) to fourth power[1]. The force is in good agreement with that predicted from an ac Stark shift gradient of the atomic ground state in the thermal radiation field[2].

[1] P. Haslinger, M. Jaffe, V. Xu, O. Schwartz, M. Sonnleitner, M. Ritsch-Marte, H. Ritsch, H. Müller, Attractive force on atoms due to blackbody radiation, *Nat. Phys*. 14 (2018) 257–260.

[2] M. Sonnleitner, M. Ritsch-Marte, H. Ritsch, Attractive Optical Forces from Blackbody Radiation, *Phys. Rev. Lett.* 111 (2013) 23601.