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# Seminar über Quanten-, Atom- und Neutronenphysik (QUANTUM)

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Lorentz-Raum (05-127), Staudingerweg 7

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## **Atom Interferometry: Gravity, Blackbody Radiation and Chameleons**

Atom interferometry has proven within the last decades its surprising versatility to sense with high precision tiniest forces. In this talk I will give an overview of our recent work using an optical cavity enhanced atom interferometer to sense with gravitational strength for fifths forces [1,2] and for an on the first-place counterintuitive inertial property of blackbody radiation [3].

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 [4] and this leads to a surprisingly strong force acting in the opposite direction of the radiation pressure [3].

If dark energy, which drives the accelerated expansion of the universe, consists of a light scalar field it might be detectable as a “fifth force” between normal-matter objects. In order to be consistent with cosmological observations and laboratory experiments, some leading theories use a screening mechanism to suppress this interaction. However, atom-interferometry presents a tool to reduce this screening [5] on so-called chameleon models [6]. By sensing the gravitational acceleration of a 0.19 kg in vacuum source mass which is  $10^{-8}$  times weaker than Earth’s gravity, we reach a natural bound for cosmological motivated scalar field theories and were able to place tight constraints [1,2].

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