

GUEST LECTURE

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(Guest of Prof. Dr. Piet O. Schmidt)

Physikalisch Technische Bundesanstalt
Bundesallee 100, 38116 Braunschweig
Raumzellenbau 11 (RZB 11), Room 113

05 December 2019, 3:30 pm

"Ultracold Sr for precision measurement and many-body physics"

Ultracold atoms provide excellent frequency references for clocks and are used as test masses in accelerometers. They are also a flexible platform to design well-controlled quantum many-body systems. We are exploiting the unique properties of strontium to advance these two research lines. Firstly we attempt to create a continuous atom laser and a continuously operating superradiant clock. Towards these goals we have built a continuous microKelvin source of Sr atoms [1, 2], developed Sisyphus cooling for Sr [3, 4] and created a steady-state Sr gas with unity phase-space density (PSD), which we are currently pushing towards a steady-state BEC. The methods developed for this experiment form also the foundation of a continuous superradiant clock that we develop within the Quantum Flagship project iqClock [5]. Secondly we work towards a quantum gas of RbSr ground-state molecules. These molecules have a large electric dipole moment and an unpaired electron, which is interesting for interaction control and many-body system design. In order to associate ultracold Rb and Sr atoms into RbSr molecules we intend to use unusual magnetic Feshbach resonances that we discovered in this system [6].

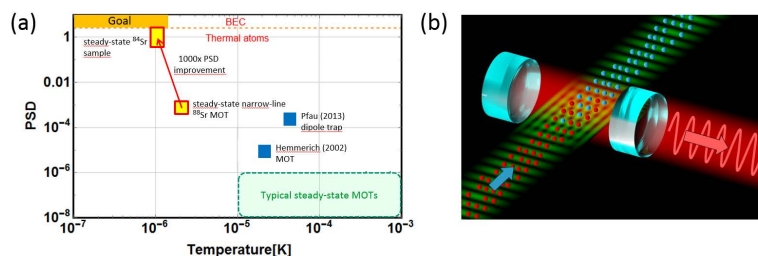


Fig. 1 (a) Figures of merit of steady-state ultracold gas samples. (b) Simplified scheme of superradiant clock.

[1] Shayne Bennetts, Chun-Chia Chen (陳俊嘉), Benjamin Pasquiou, and Florian Schreck, Steady-State Magneto-Optical Trap with 100-Fold Improved Phase-Space Density, Phys. Rev. Lett. 119, 223202 (2017).

[2] Chun-Chia Chen, Shayne Bennetts, Rodrigo González Escudero, Benjamin Pasquiou, and Florian Schreck, Continuous guided strontium beam with high phase-space density, arXiv:1907.02793 (2019).

[3] Alexandre Cooper, Jacob P. Covey, Ivaylo S. Madjarov, Sergey G. Porsev, Marianna S. Safronova, and Manuel Endres, Alkaline-Earth Atoms in Optical Tweezers, Phys. Rev. X 8, 041055 (2018).

[4] Chun-Chia Chen (陳俊嘉), Shayne Bennetts, Rodrigo González Escudero, Florian Schreck, Benjamin Pasquiou, Sisyphus Optical Lattice Decelerator, Phys. Rev. Lett. 100, 023401 (2019).

[5] <https://www.iqclock.eu/>

[6] Vincent Barbé, Alessio Ciamei, Benjamin Pasquiou, Lukas Reichsöllner, Florian Schreck, Piotr S. Żuchowski, and Jeremy M. Hutson, Observation of Feshbach resonances between alkali and closed-shell atoms, Nature Physics 14, 881 (2018).

All DQ-mat members and all interested
are cordially invited to attend.