A 4: Ultracold atoms, ions, and BEC I (joint session A/Q)

Time: Tuesday 14:00–15:30 Location: H1

Invited Talk A 4.1 Tue 14:00 H1

Reducing their complexity and miniaturise BEC interferometers — •Waldemar Herr[1], Hendrik Heine[1], Alexander Kassner[2], Christoph Künzler[2], Marc C. Wurz[2], and Ernst M. Rasel[1] — [1]Institut für Quantenoptik, Leibniz Universität, Hannover, Germany — [2]Institut für Mikroproduktionstechnik, Leibniz Universität, Hannover

Matterwave interferometry with Bose Einstein Condensates (BEC) promises exciting prospects in inertial sensing and research on fundamental physics both on ground and in space. By now, we can create BECs very efficiently by using atom chips and compact realisations have already been shown, e.g. by creating the first BEC in space on a sounding rocket mission. However, for in-field or satellite-borne applications, it is vital to further reduce the complexity in order to lower size, weight and power demands and to transform BEC interferometers to easy-to-use devices.

In this talk, different aspects ranging from interferometry schemes, sensor fusion concepts and results on a magneto optical trap and sub-Doppler cooling using only a single beam of light in combination with an optical grating on an atom chip will be discussed.

Invited Talk A 4.2 Tue 14:30 H1

Dynamics of a mobile hole in a Hubbard antiferromagnet — •Martin Lebrat, Geoffrey Ji, Muqing Xu, Lev Haldar Kendrick, Christie S. Chiu, Justus C. Brüggenjürgen, Daniel Greif, Annabelle Bohrdt, Fabian Grusdt, Eugene Demler, and Markus Greiner — Harvard University, Cambridge, MA, USA

The interplay between spin and charge underlies much of the phenomena of the doped Hubbard model. Quantum simulation of the Hubbard model using quantum gas microscopy offers site-resolved readout and manipulation, enabling detailed exploration of the relationship between the two. We use this platform to explore spin and charge dynamics upon the delocalization of an initially-pinned hole dopant. We first prepare a two-component quantum gas of Lithium-6 loaded into a square optical lattice at half-filling and strong interactions, where the atoms exhibit antiferromagnetic spin ordering. During the loading process, we use a digital micromirror device to pin a localized hole dopant into the antiferromagnet. We then release the dopant and examine how it interacts with and scrambles the surrounding spin environment. The microscopic dynamics of dopants may provide further insight into the phases that appear in the doped Hubbard model.

Invited Talk A 4.3 Tue 15:00 H1

Interaction-induced lattices for bound states: Designing flat bands, quantized pumps and higher-order topological insulators for doublons — •Grazia Salerno, Giandomenico Palumbo, Nathan Goldman, and Marco Di Liberto — Center for Nonlinear Phenomena and Complex Systems,Universit *e Libre de Bruxelles, CP 231, Campus Plaine, B-1050 Brussels, Belgium

Bound states of two interacting particles moving on a lattice can exhibit remarkable featuresthat are not captured by the underlying single-particle picture. Inspired by this phenomenon, weintroduce a novel framework by which genuine interaction-induced geometric and topological effectscan be realized in quantum-engineered systems. Our approach builds on the design of effectivelattices for the center-of-mass motion of two-body bound states, which can be created throughlong-range interactions. This general scenario is illustrated on several examples, where flat-bandlocalization, topological pumps and higher-order topological corner modes emerge from genuineinteraction effects. Our results pave the way for the exploration of interaction-induced topologicaleffects in a variety of platforms, ranging from ultracold gases to interacting photonic devices.