Abstract Submitted
for the DAMOP12 Meeting of
The American Physical Society

Inter-band dynamics in a tunable hexagonal lattice PATRICK WINDPASSINGER, MALTE WEINBERG, JULIETTE SIMONET, JULIAN STRUCK, CHRISTOPH OELSCHLAEGER, DIRK LUEHMANN, KLAUS SENGSTOCK, Institute of Laser Physics, Universitaet Hamburg — Hexagonal lattices have recently attracted a lot of attention in the condensed matter community and beyond. Upon other intriguing features, their unique band structure exhibits Dirac cones at the corners of the Brillouin zone of the two lowest energy bands. Here, we report on the experimental observation of momentum-resolved inter-band dynamics of ultracold bosons between the two lowest Bloch bands (s- and p-band) of a hexagonal optical lattice with tunable band structure. Due to the spin-dependency of the lattice potential [1,2], a rotation of the magnetic quantization axis and the choice of the atomic spin state allow for an in-situ manipulation of the lattice structure from hexagonal to triangular geometry. It is thus possible to modify the band structure and open a gap at the Dirac cones. The loading of atoms into the excited band is achieved by a microwave transition between different spin states which in certain cases is only allowed as a result of interaction effects. We observe the time-dependent population of quasi momenta, revealing a striking influence of the existence of Dirac cones on the dynamics of atoms in the first two energy bands.

[1] P. Soltan-Panahi et al., Nature Physics 7, 43 (2011)
[2] P. Soltan-Panahi et al., Nature Physics 8, 71 (2012)

Patrick Windpassinger
Institute of Laser Physics, Universitaet Hamburg

Date submitted: 23 Jan 2012

Electronic form version 1.4