Abstract Submitted
for the DAMOP11 Meeting of
The American Physical Society

Momentum-resolved spectroscopy of ultracold fermions in optical lattices CHRISTOPH BECKER, SÖREN GÖTZE, JANNES HEINZE, JASPER KRAUSER, BASTIAN HUNDT, NICK FLÄSCHNER, DIRK-SÖREN LÜHMANN, KLAUS SENGSTOCK, Institute of Laserphysics, University of Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany — The periodic dispersion of electrons in crystals gives rise to many important phenomena in solid-state physics. To characterize such systems a measurement of the energies and fillings is required for the lowest bands. Ultracold fermionic atoms in optical lattices show essentially the same physics, however, with much better control over the system parameters. This includes especially the arbitrary tuning between different lattice depths: From weak to strong lattices, conductive and insulating phases can be realized. We present a spectroscopy method which is sensitive to both, form and filling of the different bands fully momentum-resolved. Thus, we can measure the full band structure and therefore extract very accurately all derived properties as e.g. the tunneling energy. Our sensitivity is promising for the extension of these studies to observe interaction shifts due to additional bosonic atoms as well as changes in the density of states for interacting fermionic gases.

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Date submitted: 02 Feb 2011 Electronic form version 1.4