SFB/TRR 21 - Seminar

10. März 2011, Ulm

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Probing magnetic order in ultracold lattice gases

The realization of antiferromagnets with optical lattices can be foreseen in the next generation of experiments with ultracold atoms. Standard observation techniques, based on noise correlations and Bragg scattering, are not sufficient for the complete characterization of different magnetic phases. In this work we propose the use of quantum polarization spectroscopy for the direct observation of spatially resolved spin-spin correlations. Our technique employs an atom-light interface for multi-component ultracold atoms in optical lattices which maps magnetic correlations into light fluctuations. As a proof of principle, we show that this non destructive method allows us to unambiguously reconstruct the rotational invariant spin-1 chain phase diagram by directly measuring magnetic order parameters. Notice also that the technique we propose is not based on any previous knowledge of the quantum phase to be characterized, but rather takes advantage of the features displayed by the probing scheme properly optimized.

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