Abstract Submitted
for the DAMOP11 Meeting of
The American Physical Society

Highly Efficient State-Selective Submicrosecond Photoionization Detection of Single Atoms MARKUS WEBER, APS, F. HENKEL, M. KRUG, J. HOFMANN, W. ROSENFELD, N. ORTEGEL, H. WEINFURTER, FACULTY OF PHYSICS, LMU MUNICH & MAX-PLANCK-INSTITUTE OF QUANTUM OPTICS TEAM — One crucial requirement for quantum computation, quantum communication, and quantum metrology is the highly efficient measurement of qubit states. For atomic qubits, the most frequently used fluorescence method allows measuring with a detection efficiency of almost unity, however, at the cost of comparably long detection times (>100 μs). Here we experimentally demonstrate an alternative detection scheme suitable for state analysis of single optically trapped atoms in less than 1 μs with an overall detection efficiency η exceeding 98% [1]. The method is based on hyperfine-state selective photoionization and subsequent registration of the correlated photoionelectron pairs by coincidence counting via two opposing channel electron multipliers. The scheme might be a key ingredient for future quantum information applications or precision spectroscopy of ultracold atoms. It might thus be applied, e.g., for imaging and site-specific readout of atoms in optical lattices, for in situ, real-time probing of ultracold atomic ensembles with sub-Poissonian accuracy, or as detector for a loophole-free test of Bell's inequality with a pair of trapped atoms at remote locations [2]. [1] F. Henkel et al., PRL 105, 253001 (2010). [2] J. Volz et al., PRL 96, 030404 (2006).

Markus Weber
APS

Date submitted: 25 Jan 2011 Electronic form version 1.4