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Non-destructive Faraday imaging of dynamically controlled ultracold atoms MIROSLAV GAJDACZ, POUL L. PEDERSEN, TROELS MøRCH, ANDREW J. HILLIARD, JAN ARLT, JACOB F. SHERSON, Department of Physics and Astronomy, University of Aarhus, Denmark — We investigate non-destructive measurements of ultra-cold atomic clouds based on dark field imaging of spatially resolved Faraday rotation [1]. In particular, we pursue applications to dynamically controlled ultracold atoms. The dependence of the Faraday signal on laser detuning, atomic density and temperature is characterized in a detailed comparison with theory. In particular the destructivity per measurement is extremely low and we illustrate this by imaging the same cloud up to 2000 times. The technique is applied to avoid the effect of shot-to-shot fluctuations in atom number calibration. Adding dynamic changes to system parameters, we demonstrate single-run vector magnetic field imaging and single-run spatial imaging of the system's dynamic behavior. The method can be implemented particularly easily in standard imaging systems by the insertion of an extra polarizing beam splitter. These results are steps towards quantum state engineering using feedback control of ultracold atoms. M. Gajdacz et al, arXiv:1301.3018

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