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Photoionization microscopy of He atoms ANETA SMOLKOWSKA, FOM Institute AMOLF, Amsterdam, The Netherlands, THOMAS BERGEMAN, SUNY Stony Brook, ARJAN GIJSBERTSEN, JULIA JUNGMANN, FOM Institute AMOLF, MARC VRAKKING, Max-Born Institute, Berlin, Germany — Since the dawn of quantum mechanics physicists have dreamt of directly observing one of the most elusive quantum objects – the wave function. The typical length scale that a wave function occupies is the atomic unit of length (a_0=0.528*10^{-10} m). Although it is quite common to observe objects with similar sizes using various types of near-field microscopy, wave functions are challenging as they change their appearance upon observation. Photoionization microscopy has been found to be an appropriate tool for investigating those quantum objects. A possible experimental set-up comprises two plates that are generating a homogeneous electric field and the photoionization process occurs in the focus of the laser. The two-dimensional flux of launched electrons is pictured on a position-sensitive detector. Characteristic oscillatory patterns in the image result from interference of various classical trajectories by which electrons move towards the detector. Two different concentric structures can be discerned as a direct and indirect ionization process. The number of dark fringes in the image is equal to the number of nodes of the electronic wave function. Here we present an experiment that allows for a direct observation of the nodal structure of the electronic wave function in atomic He.

Thomas H. Bergeman
SUNY Stony Brook

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