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Probing Surface Patch Fields with Rydberg Atoms[1] YU PU, DEAN NEUFELD, BARRY DUNNING, Rice University — The stray electric patch fields present at a Au(111) surface are investigated by studying the ionization of Rydberg atoms incident at near-grazing angles. Measurements of the threshold conditions for observation of the resulting ions are used to estimate the size, and other characteristics, of the stray fields. This is accomplished using an iterative procedure and calculating the threshold conditions for different assumed field parameters using a simple over-the-barrier model of surface tunneling. Excellent fits to the experimental data are obtained over a broad range of n and angles of incidence and indicate that the stray fields can be as large as $\sim 10^3$ V/cm 100nm from the surface decreasing to $\sim$ 20V/cm 500 nm from the surface. The use of lithographically-patterned electrode arrays to further study the effects of stray fields is being explored. Simulations suggest that engineered electrode structures, which can generate localized fields approaching 10^4 V/cm, will help evaluate the potential of Rydberg atoms as a tool to detect and characterize stray fields as well as allow the detection of low-n($n \sim 10$) Rydberg atoms.

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