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High accuracy potential calculations for atom-ion chambers JANINE SHERTZER, JACOB GOLDE, PAUL OXLEY, College of the Holy Cross — Although commercial packages are available for calculating the electric potential in atom-ion chambers, it is often difficult to input the details of the specific geometry and configuration of various components. One can obtain highly accurate solutions to Laplace's equation for any type of chamber using the finite element method (FEM). FEM is sufficiently straightforward that it can be implemented by undergraduate students. Our interest is in designing a chamber for laser excitation of atoms which evolve into coherent elliptical states (CES); the CES atoms subsequently undergo charge transfer collisions with an ion beam. We present FEM results for a grounded cylindrical chamber with five concentric rings. By a careful choice of geometry and potentials applied to the rings we have optimized the electric field to be uniform to within 0.1% over approximately 70% of the 2mm-diameter laser excitation region. The required field homogeneity is attained without the use of fine metal meshes over the rings, which in real experiments can introduce un-calculable perturbations to the potential.

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