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Laser Cooling and Trapping of Neutral Mercury Atoms Using an Optically-Pumped External-Cavity Semiconductor Laser[1] JUSTIN PAUL, CHRISTIAN LYTLE, R. JASON JONES, University of Arizona — The level structure of the Hg atom is similar to other alkaline earth-like atoms, offering the possibility to realize an extremely high quality resonance factor (Q) on the "clock" transition ($^1S_0$- $^3P_0$) when confined in an optical lattice at the Stark-shift free wavelength. A key feature of the Hg system is the reduced uncertainty due to black-body induced Stark shifts, making it an interesting candidate as an optical frequency standard. One challenge to laser-cooling neutral Hg atoms is finding a reliable source for cooling on the $^1S_0{-}^3P_1$ transition at 253.7 nm. We employ an optically pumped semiconductor laser (OPSEL) operating at 1015 nm, whose frequency is quadrupled in two external-cavity doubling stages to generate over 120 mW at 253.7 nm. With this new laser source we have trapped Hg^{199} from a background vapor in a standard MOT. We trap up to 2 x 10^6 atoms with a $1/e^2$ radius of our MOT of $\sim$310 microns, corresponding to a density of 1.28 x 10^{10} atoms/cm^3. We report on the progress of our Hg system and plans for precision lattice-based spectroscopy of the clock transition.

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R. Jason Jones
University of Arizona

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