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A Laser Cooling Scheme for Ti-like Elements[1] SCOTT EUSTICE, KAYLEIGH CASSELLA, DAN STAMPER-KURN, University of California, Berkeley — While immense progress has been made by cooling simple atoms to quantum degeneracy, such as the alkalis, cooling atoms with more internal degrees of freedom will allow the realization of more complicated states of quantum matter. We have identified Ti, Zr, Fe, and Ru as atoms with distinct internal structure compared to already cooled species, that are accessible with standard cooling methods. All have ground states with $L \neq 0$, leading to large vector and tensor polarizabilities and thus anisotropic atom-light interactions. They also have low magnetic moments ($\mu = 4/3\mu_B$), which limits the dipole-dipole interactions that reduces coherence and the lifetime of spin mixtures in magnetic atoms, Rydberg atoms, and dipolar molecules. We focus on Ti as the target of our initial cooling efforts. While a closed transition does not exist out of the Ti ground state [Ar] $3d^2 4s^2$ a^3F_2, a metastable $3d^3 4s$ a^5F_5 state has a closed and broad transition at 498.1713 nm to the excited $3d^3 4p$ y^5G_6 state. The linewidth of $\Gamma = 2\pi \times 10.51$ MHz will allow us to create a Ti gas at 250 μK by using a spin-flip Zeeman slower and a MOT. We report on experimental progress towards a trapped, cold gas of bosonic ^{48}Ti and future plans to achieve quantum degeneracy.

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