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Trapping and cooling of sodium atoms for assembly of dipolar molecules YICHAO YU, NICHOLAS R HUTZLER, LEE R LIU, JESSIE T ZHANG, KANG-KUEN NI, Harvard Univ — In order to create a diatomic molecule with a large electric dipole moment, it is generally necessary to use atoms with very different electronegativities. In the context of bi-alkali molecules, this means combining a light alkali atom with a heavy one. This is the reason why we use NaCs in our molecule assembler experiment; NaCs has the largest induced dipole moment in few kV/cm lab fields. However, the use of sodium atoms also poses challenges. The higher Doppler temperature and lack of efficient D2 polarization gradient cooling increases the necessary depth of our optical dipole (tweezer) traps. The lack of a convenient magic wavelength for the dipole trap creates a large AC stark shift on the optical transition as well as additional heating mechanisms. The light mass of the sodium, and therefore larger Lamb-Dicke parameter and higher recoil temperature, makes it more difficult to perform efficient Raman sideband cooling on the atom in the trap. I will discuss the techniques we use to overcome these challenges, in particular a method to eliminate the light shifts and associated heating mechanisms in tight optical traps.

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