

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.