FUNCTIONALIZED AROMATIC MOLECULES FOR LASER COOLING AND TRAPPING

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Rapid and repeated scattering of laser photons (“optical cycling”) underlies many uses of atoms and small molecules for quantum science and measurement. Larger polyatomic molecules are also appealing targets, partly because these species may be decorated with functional groups offering unique scientific opportunities. In this talk, we discuss a large class of aromatic molecules that can be functionalized with an alkaline-earth metal atom to enable optical cycling. We describe the gas-phase production of Ca- and Sr-bearing derivatives of phenyl (Ph) and naphthyl radicals and, using dispersed fluorescence spectroscopy, we show that these molecules contain multiple electronic transitions suitable for optical cycling and laser cooling. We present high-resolution laser excitation spectra for molecules such as fluorinated-CaOPh and SrOPh and compare these to the well-known alkaline-earth monoalkoxides and monoamides. These data inform ongoing work to laser cool and magneto-optically trap a functionalized aromatic molecule.