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"Doppler Cooling of Molecules"

Extending the techniques of Doppler cooling from atoms to molecules is challenging due to the complex nature of molecular structure. Rotation and vibration of the molecule result in additional dark states which may require repumping, and higher order processes such as photodissociation and predissociation may terminate the cooling process. Despite these difficulties, a number of molecular candidates have been proposed, and cooling in the transverse direction has been demonstrated in SrF. A candidate which we are considering is SiO+, whose structure is similar to SrF with the added complication of a low-lying electronic state. By modeling the cooling process, we determine that the intervening state is not prohibitive to cooling and does not require repumping since decay out of it is sufficiently fast.