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"Towards Doppler cooling of SiO^+ and internal cooling of AlH^+"

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 cycling transition as with AlH^+. With the use of a pulse-shaped broadband femtrosecond laser, the internal state of AlH^+ can be optically cooled to the two lowest rovibrational states as modeled by a rate-equations approach. An atomic ion (Ba^+) then provides translational cooling. SiO^+ is a promising candidate for laser cooling, differing from previous candidates in that the cycling scheme involves three electronic states. Using a rate-equation approach, our group has modeled the cooling process and found that the intervening electronic state does not require additional repumping, since decay out of it is sufficiently fast. Wepresent our current efforts towards internal cooling of AlH^+ and Doppler cooling of SiO^+.