Density and phase-space compression of molecular gases in magneto-electrostatic traps

Yuval Shagam[1], Edvardas Narevicius[1]

[1]*Department of Chemical Physics, Weizmann Institute of Science, Rehovot 76100, Israel*
yuvalsh@weizmann.ac.il

We introduce, analyze, and compare two methods of single-photon cooling that generically cool and compress molecular gases. The first method compresses the molecular gas density by 3 orders of magnitude and increases collision frequency in trapped samples. The second method compresses the phase-space density of the gas by at least 2 orders of magnitude. Designed with combinations of electric and magnetic fields, these methods cool the molecules from ~100 to 1 mK using a single irreversible state change. They can be regarded as generic cooling schemes applicable to any paramagnetic and polar molecule. The high efficiency calculated, compared to schemes involving cycling, is a result of cooling the molecules in a single step. [1]

References:
[1] Yuval Shagam and Edvardas Narevicius, Phys. Rev. A 85, 053406 (2012).