Blackbody-radiation-assisted manipulation of trapped HD+ ions with a two-photon transition in the vibrational ground state

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Résumé

Groupe : Spectroscopie et applications This contribution addresses the control of the internal degrees of freedom of heteronuclear molecular hydrogen ions, trapped in a linear Paul trap, sympathetically cooled with Be+ ions and manipulated in specific states by resonant-enhanced-multiphoton-dissociation (REMPD). Rotational cooling was demonstrated with optical-pumping of rovibrational dipole transitions. The use of two-photon transitions between rotational energy levels in the vibrational ground state is proposed here for population transfer schemes mediated by the blackbody radiation. A set of a few HD+ ion energy levels, coupled by a two-photon rotational transition and by a REMPD scheme (two-photon rovibrational transition and electronic transition), is described with a set of rate equations based on Einstein coefficients and transition rates. The coupling with a two-photon rotational transition allows efficient change of the population in the vibrational ground state that is detected with the REMPD scheme. This approach may push the fractional resolution of molecular hydrogen ions spectroscopy at $< 10\hat{}(-12)$ level.

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