Abstract Submitted
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Ion-neutral chemistry at ultralow energies:Dynamics of reactive collisions between laser-cooled Ca^+ or Ba^+ ions and Rb atoms in an ion-atom hybrid trap[1] O. DULIEU, Laboratoire Aime Cotton, CNRS, Univ. Paris-Sud, ENS Cachan, Orsay, F.H.J. HALL, P. EBERLE, G. HEGI, Department of Chemistry, University of Basel, Switzerland, M. RAOULT, M. AYMAR, Laboratoire Aime Cotton, CNRS, Univ. Paris-Sud, ENS Cachan, Orsay, S. WILLITSCH, Department of Chemistry, University of Basel, Switzerland — Cold chemical reactions between laser-cooled Ca^+ or Ba^+ ions and Rb atoms were studied in an ion-atom hybrid trap [1]. Reaction rate constants were determined in the collision energy range E_{coll}/k_B = 20 mK-20 K. Product branching ratios were studied using resonant-excitation mass spectrometry. The dynamics of the reactive processes including the radiative formation of $CaRb^+$ and $BaRb^+$ molecular ions has been analyzed using accurate potential energy curves and quantum-scattering calculations for the radiative channels. It is shown that the energy dependence of the reaction rates is governed by long-range interactions, while its magnitude is determined by short-range non-adiabatic and radiative couplings. The quantum character of the collisions is predicted to manifest itself in the occurrence of narrow shape resonances at well-defined collision energies. The present results highlight both universal and system-specific phenomena in cold ion-neutral collisions.

[1] F.H.J. Hall et al., Phys. Rev. Lett. 107, 243202 (2011).
[2] F.H.J. Hall et al. accepted by Mol. Phys. (arXiv:1301.0724).

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