Physikalisches Institut
Fakultät für Mathematik und Physik
Albert-Ludwigs-Universität Freiburg

IRTG-Seminar

Dr. Olivier Dulieu
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“Cold neutral and ionic molecules: a playground for quantum control”

Dilute gases of ultracold atoms and molecules are at the heart of amazing progress over the past thirty years in atomic, molecular and optical physics from both experimental and theoretical points of view. The ultralow velocity of the particules allows for long observation times and induces an extreme sensitivity to weak interactions, thus unveiling properties usually hidden at room temperatures, and opening unique opportunities for controlling matter at the single quantum level.
In our group we are focusing our theoretical studies on two kinds of molecular systems:
- Cold molecular ions produced in an hybrid trap of laser-cooled alkali-metal atoms and alkaline-earth ions [1];
- Cold neutral dipolar molecules composed of alkali-metal atoms [2] and alkaline-earth atoms [3];
Such systems exhibit a rich dynamics often assisted or controlled by light. They are suitable for studying anisotropic interactions between particles, with exciting prospects toward ultracold chemistry and quantum simulation.
I shall present an overview of our recent theoretical achievements in this domain. Both projects are based on new accurate quantum chemistry computations of potential energy surfaces of ground and excited molecular states and of relevant transition dipole moments.

[1] H. da Silva Jr, M. Raoult, M. Aymar, O. Dulieu, New J. Phys. 17, 045015 (2015)
[2] D. Borsalino, R. Vexiau, M. Aymar, E. Luc-Koenig, O. Dulieu, N. Bouloufa-Maafa, J. Phys. B, 49, 055301 (2016)
[3] P. Zuchowski, R. Guérout and O. Dulieu, Phys. Rev. A 90, 012507 (2010).

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Tuesday, May 24th, 2016, 4:00 p.m., HS I,
Physics High Rise, Hermann-Herder-Str. 3