

DAMOP12-2012-000067

Abstract for an Invited Paper
for the DAMOP12 Meeting of
the American Physical Society

Trilobites and other molecular animals: How Rydberg-electrons catch ground state atoms

TILMAN PFAU, Universitaet Stuttgart

We report on laser spectroscopy results obtained in a dense and frozen Rydberg gas. Novel molecular bonds resulting in ultralong-range Rydberg dimers were predicted [1] and dimers as well as trimers in different vibrational states were found [2]. Some of these states are predicted to be bound by quantum reflection. Lifetime measurements confirm this prediction. Coherent superposition between free and bound states have been investigated [3]. Recently we have also confirmed that in an electric field these homonuclear molecules develop a permanent dipole moment [4].

[1] C. H. Greene, A. S. Dickinson, and H. R. Sadeghpour, *Phys. Rev. Lett.* **85**, 2458 (2000).

[2] V. Bendkowsky, B. Butscher, J. Nipper, J. P. Shaffer, R. Löw, T. Pfau, *Nature* **458**, 1005 (2009), V. Bendkowsky, B. Butscher, J. Nipper, J. Balewski, J. P. Shaffer, R. Löw, T. Pfau, W. Li, J. Stanojevic, T. Pohl, and J. M. Rost, *Phys. Rev. Lett.* **105**, 163201 (2010).

[3] B. Butscher, J. Nipper, J. B. Balewski, L. Kukota, V. Bendkowsky, R. Löw, and T. Pfau *Nature Physics* **6**, 970–974 (2010).

[4] W. Li, T. Pohl, J. M. Rost, Seth T. Rittenhouse, H. R. Sadeghpour, J. Nipper, B. Butscher, J. B. Balewski, V. Bendkowsky, R. Löw, T. Pfau, *Science* **334**, 1110 (2011).