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Spectroscopy of Rydberg atoms and quantum information

Highly excited Rydberg atoms have many unique properties compared to low-excited atoms: large electron orbit radius, large dipole moments of transitions between neighboring states, strong long-range interactions, long radiative lifetimes, huge polarizabilities, etc. Laser and microwave spectroscopy of Rydberg atoms can reveal these properties by observing the quantum interference, dephasing, shifts or broadenings of various resonances in single Rydberg atoms. Single Rydberg atoms are detected using the selective field ionization technique. Control of long-range interactions between Rydberg atoms by laser and microwave radiations, as well as by external electric and magnetic fields, forms the basis for quantum information processing with neutral trapped atoms. In this presentation we will give a review of our experimental and theoretical results on laser and microwave spectroscopy of Rb and Na Rydberg atoms and their connection to quantum information. Among these results there are the Stark and Zeeman effects at microwave and optical transitions [1-3,5,8,9,13], quantum interferometry of degenerate and non-degenerate Rydberg states [1-3], excitation and detection statistics of Rydberg atoms with single-atom resolution [4,5,8,9], long-range Stark-tuned Förster resonances between a few Rydberg atoms [5,8,9,10], three-photon excitation spectroscopy with pulsed and cw lasers [8,12,13], ultracold plasma effects [13], ionization and quenching of Rydberg atoms by blackbody radiation [6,7], and deterministic single-atom excitation using dipole blockade and chirped laser pulses [11].

[1] I.I.Ryabtsev et al., Phys. Rev. A 61, 063414 (2000) [2] I.I.Ryabtsev et al., Phys. Rev. A 64, 033413 (2001) [3] I.I.Ryabtsev et al., J. Phys. B 36, 297 (2003) [4] I.I.Ryabtsev et al., J. Phys. B 38, S421 (2005) [5] I.I.Ryabtsev et al., Phys. Rev. A 76, 012722 (2007) [6] I.I.Beterov et al., New J. Phys., 11, 013052 (2009) [7] I.I.Beterov et al., Phys. Rev. A 79, 052504 (2009) [8] D.B.Tretyakov et al., JETP 108, 374 (2009) [9] I.I.Ryabtsev et al., Phys. Rev. Lett. 104, 073003 (2010) [10] I.I.Ryabtsev et al., Phys. Rev. A 82, 053409 (2010) [11] I.I.Beterov et al., Phys. Rev. A 84, 023413 (2011) [12] I.I.Ryabtsev et al., Phys. Rev. A 84, 053409 (2011) [13] D.B.Tretyakov et al., JETP 114, 14 (2012)

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