

Experimentalphysik III

Relativitätstheorie, Quantenphysik, Kern- & Teilchenphysik

Prof. Dr. Kilian Singer

14.12.2015

Mo 11-13 Uhr (Raum 3137)

Mo 14-16 Uhr (Raum 0282)

Sprechstunde: Mo 16-17 Uhr (Raum 1166)

Übungen:

Mi, 15-17 Uhr (in Raum 1252: ca. 40 Plätze)

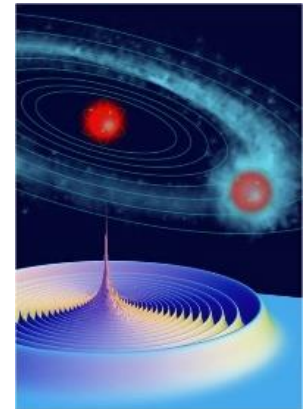
Videoaufzeichnung und Vorlesungsmaterial:

<http://adventure.zdv.uni-mainz.de/modernphysics>

<http://adventure.zdv.uni-mainz.de/chat/>

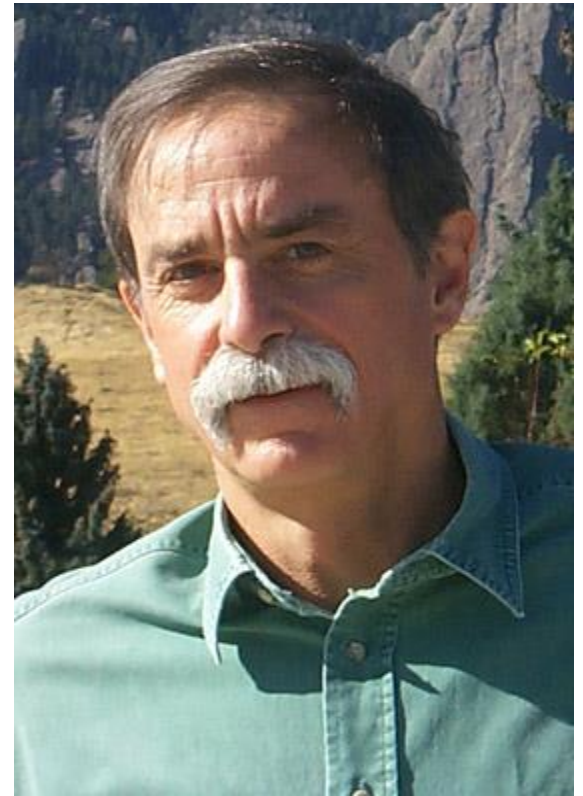
Extreme Eigenschaften von Rydberg Atomen

Property	Formula	$(n^*)^x$	Rb(60d)
Binding energy E_n	$-\frac{R_{Ryd}}{(n^*)^2}$	$(n^*)^{-2}$	3.96 meV
Energy spacing	$E_n - E_{n-1}$	$(n^*)^{-3}$	33.5 GHz
Orbital radius $\langle r \rangle$	$\simeq \frac{1}{2} (3(n^*)^2 - \ell(\ell + 1))$	$(n^*)^2$	5156 a_0
Geo. cross section	$\pi \langle r \rangle^2$	$(n^*)^4$	$8.35 \times 10^7 a_0^2$
Dipole moment	$\langle nd er nf \rangle$	$(n^*)^2$	138.3 ea_0
Polarizability	$2e^2 \sum_{n \neq n', l, m} \frac{ \langle nlm z n'l'm' \rangle ^2}{E_{nlm} - E_{n'l'm'}}$	$(n^*)^7$	$191 \frac{\text{MHz}}{(\text{V/cm})^2}$
Radiative lifetime	2.09 ns $(n^*)^{2.85}$	$(n^*)^3$	215 μs
Black body transition	$\frac{1}{\tau_{nl}^{bb}} = \frac{4\alpha^3 kT}{3(n^*)^2}$	$(n^*)^{-2}$	1 kHz
Fine structure	$4.8 \times 10^6 \text{ MHz} \frac{5}{2} (n^*)^{-3}$	$(n^*)^{-3}$	59 MHz





Serge Haroche



Dave Wineland

MEASURING AND MANIPULATING INDIVIDUAL
QUANTUM SYSTEMS

Nobel prize 2012

Nichtdestruktive Messung einzelner Photonen

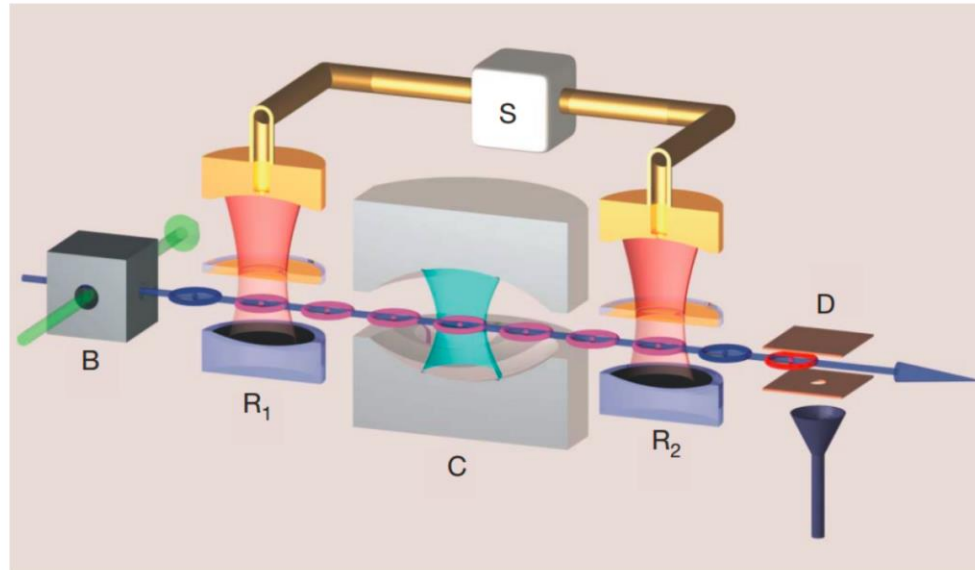


Figure 1 | Experimental set-up. Samples of circular Rydberg atoms are prepared in the circular state g in box B, out of a thermal beam of rubidium atoms, velocity-selected by laser optical pumping. The atoms cross the cavity C sandwiched between the Ramsey cavities R_1 and R_2 fed by the classical microwave source S, before being detected in the state selective field ionization detector D. The R_1 -C- R_2 interferometric arrangement, represented here cut by a vertical plane containing the atomic beam, is enclosed in a box at 0.8 K (not shown) that shields it from thermal radiation and static magnetic fields.