



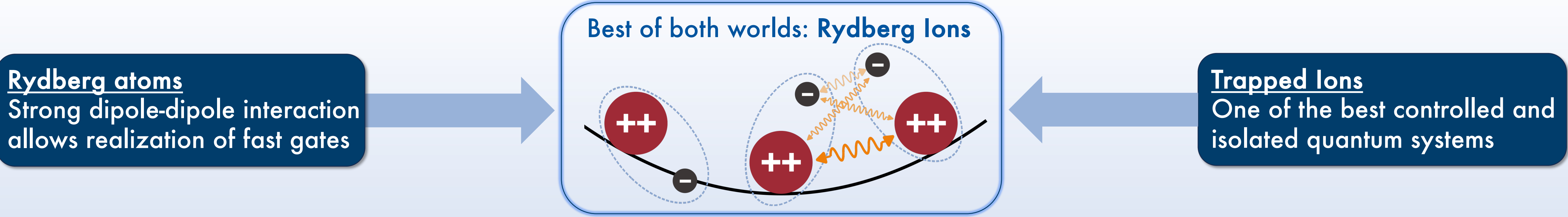
Quantum Information Processing with Trapped Rydberg Ions

Katrin Bolsmann, Thiago L. M. Guedes & Markus Müller @ RWTH Aachen, FZ Jülich
Joseph W. P. Wilkinson & Igor Lesanovsky @ Universität Tübingen

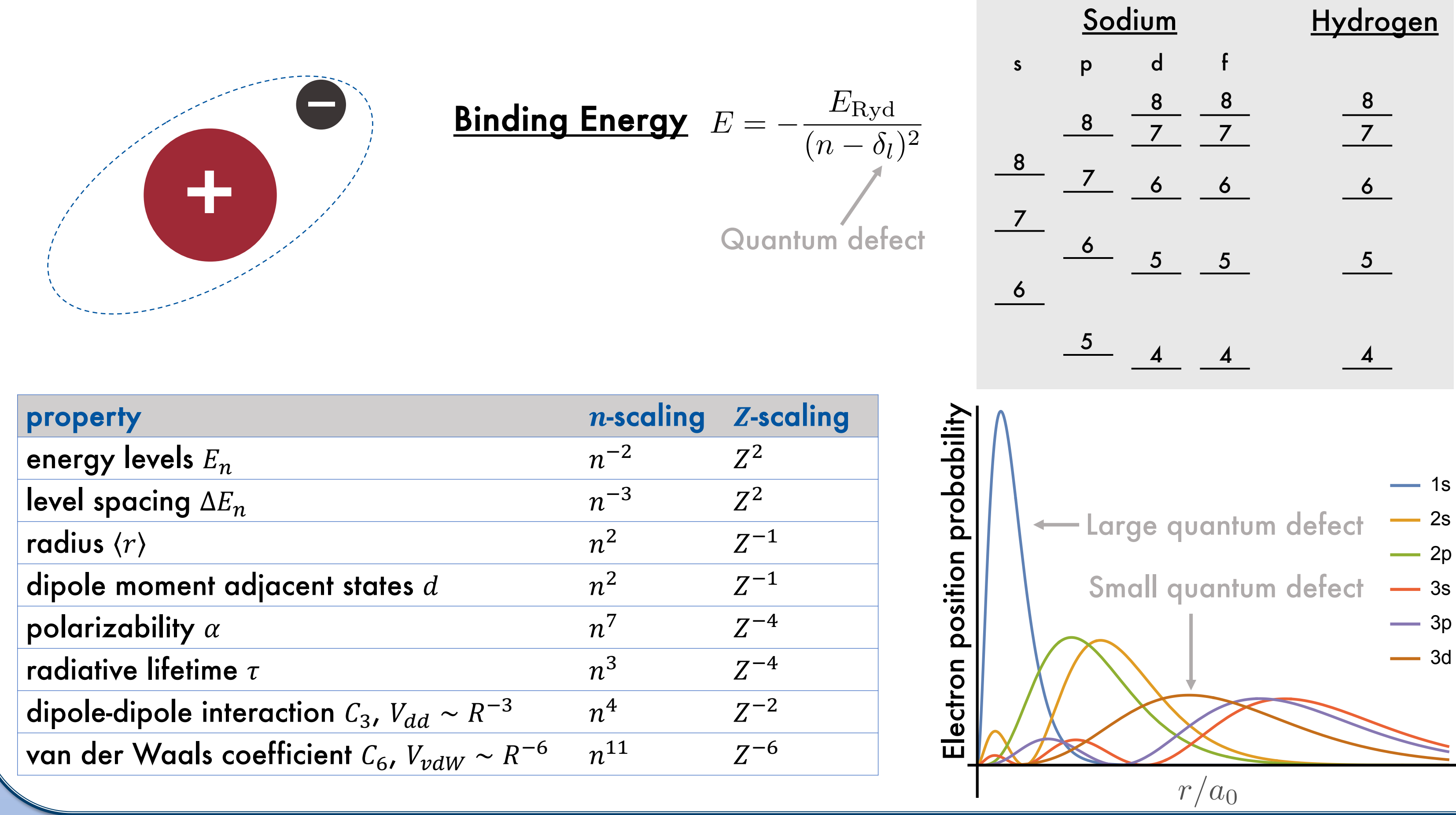


ABSTRACT

Combining the strong and long-range interaction of cold Rydberg atoms with the controllability of trapped ions, ultracold trapped Rydberg ions provide a promising platform for scalable quantum computing. We demonstrate how microwave-dressed Rydberg states result in rotating permanent dipole moments causing strong dipole-dipole interaction between ions in highly excited Rydberg states. Due to the large difference in time scales, the fast electronic dynamics of the Rydberg ions decouple from the slower oscillator modes in the linear Coulomb crystal. These properties allow us to realize a submicrosecond two-qubit gate between two Rydberg ions confined in a Paul trap reaching fidelities of > 99% under consideration of the finite lifetime of the Rydberg states at room temperature.



RYDBERG PHYSICS



MICROWAVE DRESSING

