The 937th IMS colloquium
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Taming Atomic Giants

How Rydberg atoms became veritable Quantum Simulators

Professor and Vice President

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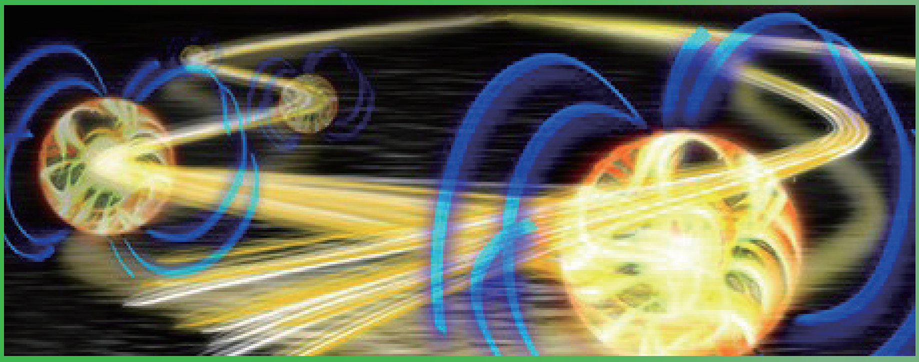
Place: IMS Research Building Room 201

Due to their exaggerated properties, highly excited (Rydberg) atoms have attracted physicists for more than a century, and the study of these atomic giants is intimately connected to major advances in modern quantum theory. In the last years, a new aspect was added to this everlasting fascination. Forces between Rydberg atoms are huge causing measurable effects over macroscopic distances in the micrometer range. As an important feature, these dipolar interactions can not only be tuned in strength, but also in their characteristic dependence on the distance between the atoms. Such control, in combination with modern methods of laser cooling and trapping, opens exciting perspectives for using Rydberg atoms as simulators for quantum many-body systems in order to address fundamental problems as, e.g., the emergence of magnetism in condensed matter or energy transport in photosynthetic complexes. In fact, it was first thought that the fragility of Rydberg atoms (the electron's binding energy is only a few millielectronvolts or below) would impede meaningful applications. Yet, recent advances in quantum engineering have promoted Rydberg atoms to one of the hottest candidates for large-scale quantum simulation. In my lecture, I will provide an introduction into this rapidly growing new field of modern physics and will give prominent examples of recent achievements.



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