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# Blazing the Trail towards a Hybrid Quantum Computer

**Prestigious Award for Young  
Innsbruck Physicist Peter Rabl**

**On Wednesday, the 26th September 2007, Dr. Peter Rabl will receive the Ludwig Boltzmann Prize 2007 for new theoretical approaches to the exchange of quantum information between atoms or molecules and superconducting nanostructures. Dr. Johannes Hahn, Austrian Minister for Higher Education and Research, will present this highest Austrian accolade for new generation physicists to Dr. Rabl in the town of Krems. Rabl's findings are an important pointer on the long road towards creating and improving quantum processors.**

The award recognizes Peter Rabl's work for his thesis at the University of Innsbruck and at the Institute for Quantum Optics and Quantum Information (IQOQI) from 2003 to 2006. It focused on new theoretical approaches to the exchange of quantum information between atoms or molecules and superconducting nanostructures. A coherent exchange of quantum information is an essential step towards realizing a so-called hybrid quantum processor. "Such a hybrid quantum processor, albeit still a fiction today, will implement tasks such as calculating and saving in different systems to utilize the combined advantages of different physical systems", Rabl explained. "Superconducting nanostructures, for instance, are suitable for fast computing, while atoms make natural long-life quantum repositories and photons (light particles) are excellent for transporting quantum information over long distances". While the principal function of each individual component could be demonstrated early on (some of it in Innsbruck and Vienna), the new and interesting challenge lies in connecting these systems. In his theoretical work, Peter Rabl analyzed the interaction of charged atoms (ions) and polar molecules with superconducting structures and was able to show that a transfer of quantum information between these systems is indeed possible under certain conditions. These findings now form an important pointer for early experiments in this area and might pave the way for creating and improving quantum processors in the future.

## **Award presented by the science minister**

The award ceremony will take place on Wednesday, September 26, 2007, in Krems, at the 57th Annual



Conference of the Österreichische Physikalische Gesellschaft (ÖPG), with federal minister Dr. Johannes Hahn presenting the award. Every year, the ÖPG recognizes promising young physicists with an award, alternately the Ludwig Boltzmann Prize for theoretical physics and the Fritz Kohlrausch Prize for experimental physics. The prize money is 2200 euros. "This is the best junior award for a physicist in this age group", explained Rabl's thesis supervisor Prof. Peter Zoller proudly. "I am very pleased that Peter Rabl's achievements have been recognized with this prize". ÖPG president is physicist Prof. Monika Ritsch-Marte of Innsbruck Medical University, herself a Ludwig Boltzmann Prize laureate and the first woman in the history of the ÖPG to head this academic society. Encouraging young scientists is one of her major concerns.

### **International success**

Peter Rabl was born 1978 in Brixlegg, Tyrol. He studied physics at the University of Innsbruck and finished in 2006 with a doctorate. Recently Rabl started as post-doc researcher at the Institute for Theoretical Atomic, Molecular and Optical Physics (ITAMP) at the Harvard Smithsonian Center for Astrophysics. He is about to take up a post as Harvard Associate at the Physics Department of Harvard University, a position he qualified for via an international competition set up to fund one young scientist each year in the field of theoretical nuclear and molecular physics. "This stipend enables me to conduct my own research largely independently for a total of three years and at the same time to benefit from the high concentration of experts in this field at the ITAMP and at the Harvard Physics Department," Peter Rabl explained. He hopes to continue focusing his research on the combination of quantum-optical and coherent solid state systems and on the physics of cold polar molecules.

You can download a picture of Dr. Peter Rabl from: <http://www.iqoqi.at/media/download/>

The acclaimed thesis is entitled: "Towards Hybrid Quantum Processors: Interfacing Quantum Optical and Solid State Qubits" Dissertation, Innsbruck 2006

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