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Press Release

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Menlo Systems honors Prof. Peter Zoller

As co-sponsor of the "Norman F. Ramsey Prize 2018," Menlo Systems would like to extend their warmest congratulations to this year's winner, Prof. Peter Zoller. The Austrian physicist is receiving the prestigious prize for his significant contribution to the theory of quantum computers, quantum communication, and the simulation of the trapping of ions, atoms, and molecules. Prof. Peter Zoller researches and teaches at the University of Innsbruck. Furthermore, he is the Scientific Director at the Institute for Quantum Optics and Quantum Information of the Austrian Academy of Sciences (ÖAW). As a theoretical physicist, Peter Zoller has published groundbreaking work on the interaction of laser light and atoms. In this interview, Peter Zoller explains his research, and describes where quantum physics might be headed in the next few years.

Mr. Zoller, you are theoretical physicist. What is the appeal in considering physical problems?

Zoller: Physics plays a very special part within the natural sciences. On the one hand we have experimental physics, where we can pose ever deeper questions about nature with sophisticated tools in the realms of experiments. On the other hand we have theoretical physics, which has the goal of describing these findings with mathematical expressions within the language of mathematics. Physics is the interplay between the knowledge gained using experiments and theory, and it is full of surprises, in fundamental science as well as applications, which result in new technology that can alter and improve our daily lives. Quantum physics is a perfect example: the laws of quantum physics don't appear to be intuitive; yet unexpected applications such as quantum computers and quantum communication can emerge from these apparent paradoxes. Being able to work creatively at these interfaces as a scientist, is one of the most appealing jobs imaginable.

In the end you chose quantum physics. How can you consider the elusive phenomena of quantum physics, without being able to physically grip them?

Zoller: Our intuition about how the world functions is typically dominated by classical considerations, which we experience in nature in our daily lives, or which we believe to experience. None-

theless, it is also possible to develop an intuition for the functioning of quantum physics. Ultimately, the guideline in our considerations of quantum phenomena is clear mathematical language, which has its own type of intuition.

How did you describe to your children, what their father researches?

Zoller: Children stand out with their unusual curiosity and dexterity. They are open to hearing about physical apparatus, experiments, and the resulting fascinating phenomena. As a theoretical physicist we don't have our own laboratories that we can impress them with, but it is definitely possible to convey the fact that we as theoreticians contribute to the development and understanding of new phenomena and their surprising applications. Especially when the topic is something exciting like the quantum computer.

We typically associate the quantum computer as a possible application with quantum physics. The "computers" could shift information technology into a new era. In 1995 Prof. Ignacio Cirac and you developed a model of a quantum computer, based on the interaction between lasers with cold ions held in electromagnetic traps. Could you explain the principle, and describe what the potential applications might be?

Zoller: The ideas and suggestions of J.I. Cirac and myself are now twenty years old, and were probably the first realistic proposal to build a programmable quantum computer. We used charged atoms held in an ion trap in a vacuum chamber, where they could be arranged in a row like pearls on a string. Each of these ions acts as a quantum Bit, which can be in a superposition of many states, contrary to a classical Bit. Laser light can be used to manipulate and read out these quantum states. This model has been realized in the laboratories of my colleague Rainer Blatt, as well as many other groups by now.

Besides quantum computers, where is quantum physics headed? What can we expect from this strange world?

Zoller: We are now experiencing the second quantum revolution, in which new technologies are being developed and applied, based on the results of fundamental science. These quantum technologies will shape the 21st century in many ways. At the same time, we are far from having uncovered all the mysteries of the quantum world. There are still many open questions on the level of fundamental science.

Scientists like to have visions. Which implementations do you envisage, and which would you like to witness?

Zoller: As a theoretical physicist working on quantum physics, and especially at the intersection with experimental quantum physics, I have been lucky enough to have observed many of our theoretical visions becoming reality through experimental developments in a way that I had not expected in my wildest dreams. This makes me both happy and proud. At the same time I am convinced: the best is yet to come.

The Norman F. Ramsey Prize:

The "Norman F. Ramsey Prize" was established by the American Physical Society (APS) with the support of three main sponsors. Each year the prize is awarded to outstanding work in the area of precise measurements of natural constants, the examination of fundamental laws of nature, and the precision spectroscopy of atoms and molecules. The prize is named after Norman Foster Ramsey. He improved spectroscopic methods in atomic, molecular, and nuclear physics. This allowed Ramsey to perform time and frequency measurements with higher precision. One of the applications is the basis of time measurements in atomic clocks.

As a manufacturer of technology for precision measurements, Menlo Systems is proud to be a part of the awarding of the prize, which includes family, friends, and industrial partners. "The annual awarding of the prize is a great possibility to honor the scientific contributions of Norman F. Ramsey in the area of precision measurements in the microcosm. Prof. Zoller was an excellent choice as the first recipient of this prize," says Dr. Michael Mei, the Managing Director.

Professor Peter Zoller will receive the prize at the "Division of Atomic, Molecular and Optical Physics" (DAMOP) conference of the American Physical Society in Fort Lauderdale (May 28th until June 1st 2018). Menlo Systems will be attending the conference as sponsor and industrial exhibitor. The participating colleagues are looking forward to greeting and congratulating Professor Zoller.

Thorsten Naeser

Translation: Benjamin Sprenger

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About Menlo Systems

Precision in Photonics. Together we shape light.

Menlo Systems, a leading developer and global supplier of instrumentation for high-precision metrology, was founded in 2001 as a spin-off of the Max Planck Institute for Quantum Optics, with the foremost aim to commercialize optical measurement technologies and make it available to newly emerging application fields. Menlo Systems maintains a strong bond to co-founder Theodor W. Hänsch, who pioneered precision laser techniques.

Known for the Nobel Prize-winning optical frequency comb technology, the Munich-based company offers complete solutions based on ultrafast lasers and synchronization electronics and THz systems for applications in industry and research.