universität innsbruck

Innsbruck Physics Colloquium

Inaugural Lectures

Tracy Northup

Institute of Experimental Physics, University of Innsbruck, Austria

Quantum interfaces: encoding information in atoms, light, and motion

Thanks to quantum physics, it is possible to encode information in the electrons that orbit atoms, in a single particle of light, or in the motion of a nanoparticle. These encodings are expected to enable powerful new technologies for computing, for secure communication, and for precision sensing. A particular challenge for future quantum technologies lies in the transfer of information between different encodings, for example, between atoms and light.

We will examine one promising solution: an optical resonator as a quantum interface. Recently, with the help of such an interface, two atoms in different buildings on the University of Innsbruck campus have been entangled with one another. We will discuss how such entanglement lays the foundation for a future quantum internet.

Alexander Kendl

Institute of Ion Physics and Applied Physics, University of Innsbruck, Austria

Nonlinear dynamics: predicting "weather", "climate" and tipping points in fusion plasma

For many hydrodynamic instabilities the nonlinearities primarily saturate an initial growth. Less known are the roles of secondary instabilities for turbulent structures in quasi two-dimensional fluids.

These can transform chaotic into ordered states through predator-prey type coupling between fast turbulent vortices and long-lived zonal flows, or jet streams. Such kind of nonlinear dynamics in the atmosphere was the cause of this year's extreme summer heat.

The very same phenomenon, in local turbulent "weather" of a heated magnetized plasma, can trigger sudden transition into a, desired, warmer global "climate" state of high confinement in fusion experiments. Recent improved models and results are discussed, which facilitate predictive simulations of plasma turbulence, transitions, and the elusive tipping elements in experiments on fusion energy.

Tuesday, 25.10.2022, at 16:00 h,
HS B (Technik)