

Quantum Atom Optics: from Environmental to Quantum Many Body Physics

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The experimental platform of atoms manipulated by light offers answers to a broad spectrum of open questions. With three explicit and very different examples I will give you glimpse how broad this spectrum is. One fundamental question in oceanography is the time when deep water in the ocean was last in exchange with the atmosphere. The possibility to detect Argon 39 atoms one by one allows the dating of water samples as small as ten liters. A very different question in physics is the generation of spatially separated entanglement in atomic gases. I will discuss what strategy allows the production and also the inference of the presence of this kind of entanglement. In the experiment we find that the system generated is at least genuine five-partite entangled. The aspect of studying isolated many body quantum systems with high level of control and for long time offers a path to detect universal time dynamics. Universal meaning, that the evolution does not depend on the initial condition and follows the scaling hypothesis in time and space. The first observation of universal time dynamics in ultracold quantum gases will be present.