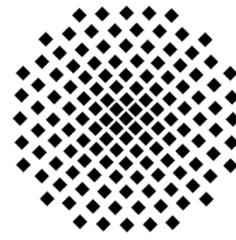


# Stuttgarter Physikalisches Kolloquium

Fachbereich Physik, Universität Stuttgart  
Max-Planck-Institut für Festkörperforschung  
Max-Planck-Institut für Intelligente Systeme

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Universität Stuttgart, Pfaffenwaldring 57, 70569 Stuttgart-Vaihingen

Gastgeber: Prof. Dr. Eric Lutz, Universität Stuttgart, Telefon: 0711 - 685-65101

## Will a single two-level atom simultaneously scatter two photons?

**Arno Rauschenbeutel**  
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### Abstract

The interaction of light with a single two-level emitter is the most fundamental process in quantum optics, and is key to many quantum applications. As a distinctive feature, two photons are never detected simultaneously in the light scattered by the emitter. This is commonly interpreted by saying that a single two-level quantum emitter can only absorb and emit single photons. However, it has been theoretically proposed that the photon anticorrelations can be thought of as arising from quantum interference between two possible two-photon scattering amplitudes, which one refers to as coherent and incoherent. This picture is in stark contrast to the aforementioned one, in that it assumes that the atom has two different mechanisms at its disposal to scatter two photons at the same time. In my talk, I experimentally validate the interference picture by showing that, when spectrally rejecting only the coherent component of the fluorescence light of a single two-level atom, the remaining light consists of photon pairs that have been simultaneously scattered by the atom. These results offer fundamental insights into the quantum-mechanical interaction between light and matter and open up novel approaches for the generation of highly non-classical light fields enabling, for example, Fourier-limited photon-pair sources that approach the theoretical limit in brightness.