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Dear Editor,

please find enclosed our manuscript entitled "Counterintuitive temporal shape of single photons". This work reports on heralded single photon generation of very narrow band photons with a particular temporal shape - we were able to demonstrate the single photon character via strong photon anti-bunching, and also assessed the temporal profile of the photons with an optical homodyne technique.

While this is one of a few cases where one could directly measure the temporal envelope of the photon field directly, a unique feature in our experiment arises from an asymmetry in the heralding sequence of the cascade decay we use for photon pair generation.

In a first arrangement, we use the photon from a decay in the upper leg of a cascade as a herald for the second photon, which, as expected, exhibits an exponential decay, corresponding to the decay of the intermediate level. This is perfectly compatible with the usual interpretation that the herald prepares an initial condition, and the physical system evolves out of it in the usual way.

In the second arrangement, however, we swapped the roles of herald and heralded photon, taking the lower decay as the herald for a photon arising out of the upper decay in the cascade. We observe an optical field envelope that is an exponential rise, which can not explained by the usual exponential decay of an atomic excitation.

This observation seems to highlight a problem with the usual way heralds are seen as a witness for a certain initial condition of a system: In fact, we do fix the final condition, but this way, we are seemingly able to reverse the dynamics of a decay process.

We believe that this is a neat example that usual interpretation of observed quantum physical processes, i.e., a state preparation, free evolution in time, and a subsequent measurement, seems to fail with this experiment, and that more general, but counterintuitive interpretations should be used.

This puzzling aspect of our work seems in our view be accessible to a wider community in physics, pointing out issues with our usual understanding of the measurement process in a relatively simple physical process.

We therefore feel that the Nature Physics journal could be an adequate platform for this work, and look forward to your reply.

With Best Regards on behalf of all authors,

Christian Kurtsiefer