

# Quantum optics breakthrough: New method generates photon triplets

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(PhysOrg.com) -- A significant breakthrough spearheaded by University of Queensland, Canadian and Austrian researchers is featured in the latest issue of the journal *Nature*.

The breakthrough was made by Thomas Jennewein, Hannes Hübel, Deny Hamel and Kevin Resch of the University of Waterloo, Canada, along with Alessandro Fedrizzi of the University of Queensland, Australia and Sven Ramelow of the Austrian Academy of Sciences.

The international research team achieved a longstanding milestone in quantum optics research — the direct generation of photon triplets. This result has been sought for years but never achieved until now.

“This is going to open a new frontier of quantum optics and allow a new class of experiments in [quantum computing](#) using photons,” lead investigator Associate Professor Thomas Jennewein said.

In the past, the generation of pairs of photons (particles of light) revolutionized [quantum optics](#) and made possible emerging technologies such as [quantum cryptography](#) and quantum computing with photons.

Typically, these photon pairs were created from strong lasers sent through a crystal — a process known as “parametric down-conversion.”

In the new approach, researchers created photon triplets by producing a first pair of photons using an optical crystal, then splitting one of the

photon pairs further into two additional photons inside a second crystal.

It's a process that was first conceived 20 years ago, but had never before been experimentally observed.

Because each triplet originates from a single pump photon, the quantum correlations will extend over all three [photons](#) in a manner not achievable when using independently created photon pairs.

It is expected that this photon-triplet source will allow tests of novel quantum correlations, and will greatly advance photonic quantum computing.

“It shows the value of a very strong team and a great environment for allowing breakthroughs to happen,” Dr Jennewein said.

In their publication, titled “Direct generation of photon triplets using cascaded photon-pair sources,” the researchers explain that these tripartite [quantum correlations](#) will significantly advance quantum information research.

**More information:** Hübel H. et al. *Nature* 466, 601-603 (2010).  
[www.nature.com/nature/journal/.../abs/nature09175.html](http://www.nature.com/nature/journal/.../abs/nature09175.html)

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