New research into light particles challenges understanding of quantum theory

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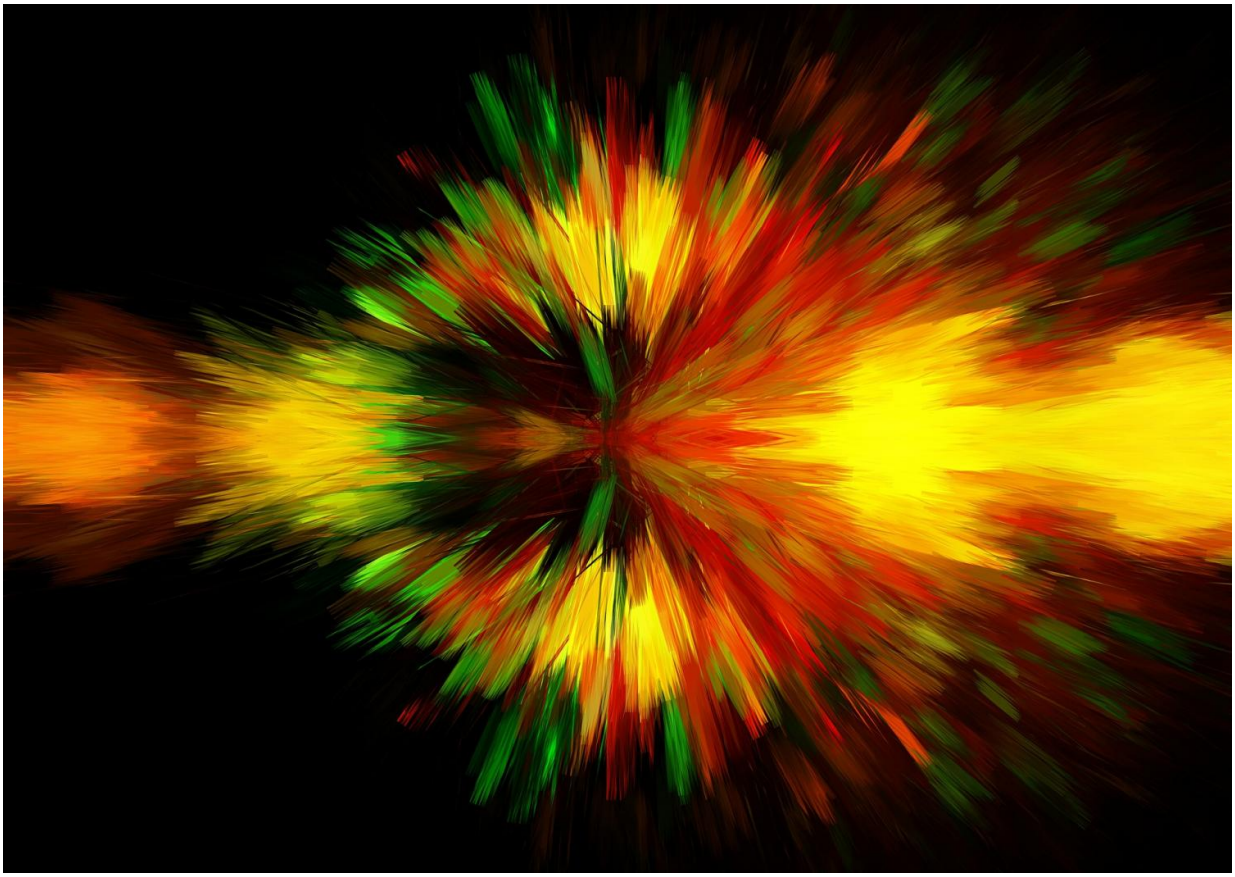

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Scientists have discovered a new mechanism involved in the creation of paired light particles, which could have significant impact on the study

of quantum physics.

Researchers at the University of East Anglia (UEA) have shown that when photons - the fundamental particles of light - are created in pairs, they can emerge from different, rather than the same, location.

The ground-breaking research could have significant implications for quantum physics, the theoretical basis of modern physics. Until now, the general assumption was that such photon pairs necessarily originate from single points in space.

Quantum entanglement - when particles are linked so closely that what affects one directly affects the other - is widely used in labs in numerous processes from quantum cryptography to quantum teleportation.

The UEA team were studying a process called spontaneous parametric down-conversion (SPDC), in which photon beams are passed through a crystal to generate entangled pairs of photons.

Prof David Andrews in UEA's School of Chemistry said: "When the emergent pairs equally share the energy of the input, this is known as degenerate down-conversion, or DDC.

"Until now, it has been assumed that such paired photons come from the same location. Now, the identification of a new delocalized mechanism shows that each photon pair can be emitted from spatially separated points, introducing a new positional uncertainty of a fundamental quantum origin."

The entanglement of the quantum states in each pair has important applications in quantum computing - theoretical computation systems that could potentially process big data problems at incredible speeds - as well as other areas of quantum physics.

The findings are also significant because they place limits on spatial resolution. Prof Andrews said: "Everything has a certain quantum 'fuzziness' to it, and photons are not the hard little bullets of light that are popularly imagined."

The study 'Nonlocalized generation of correlated photon pairs in degenerate down-conversion' by Kayn A. Forbes, Jack S. Ford, and David L. Andrews is published in the journal *Physical Review Letters*.

Provided by University of East Anglia

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