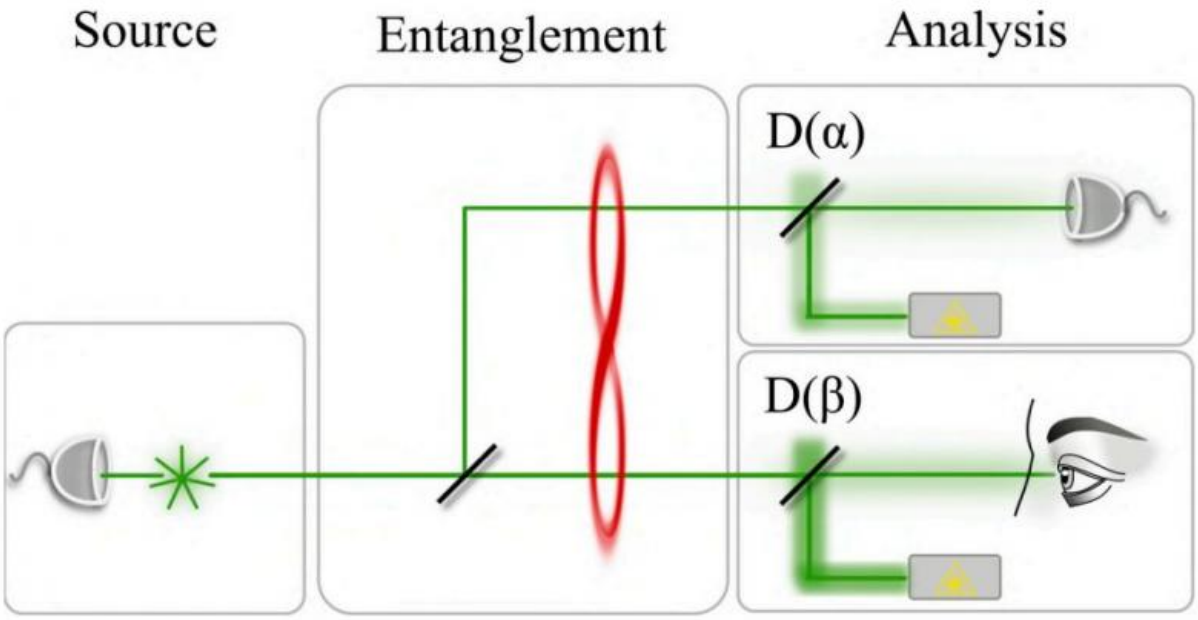
An idea for allowing the human eye to observe an instance of entanglement

February 18 2016, by Bob Yirka



Scheme of the proposal for detecting entanglement with the human eye. Credit: arXiv:1602.01907 [quant-ph]

(Phys.org)—A trio of physicists in Europe has come up with an idea that they believe would allow a person to actually witness entanglement. Valentina Caprara Vivoli, with the University of Geneva, Pavel Sekatski, with the University of Innsbruck and Nicolas Sangouard, with the University of Basel, have together written a paper describing a scenario where a human subject would be able to witness an instance of

entanglement—they have uploaded it to the *arXiv* server for review by others.

Entanglement, is of course, where two quantum particles are intrinsically linked to the extent that they actually share the same existence, even though they can be separated and moved apart. The idea was first proposed nearly a century ago, and it has not only been proven, but researchers routinely cause it to occur, but, to date, not one single person has every actually seen it happen—they only know it happens by conducting a series of experiments. It is not clear if anyone has ever actually tried to see it happen, but in this new effort, the research trio claim to have found a way to make it happen—if only someone else will carry out the experiment on a willing volunteer.

The idea involves using a beam splitter and two beans of light—an initial beam of coherent photons fired at the beam splitter and a secondary beam of coherent photons that interferes with the photons in the first beam causing a change of phase, forcing the light to be reflected rather than transmitted. In such a scenario, the secondary beam would not need to be as intense as the first, and could in fact be just a single coherent photon—if it were entangled, it could be used to allow a person to see the more powerful beam while still preserving the entanglement of the original photon.

The researchers suggest the technology to carry out such an experiment exists today, but also acknowledge that it would take a special person to volunteer for such an assignment because to prove that they had seen entanglement taking place would involve shooting a large number of photons in series, into a person's eye, whereby the resolute volunteer would announce whether they had seen the light on the order of thousands of times.

More information: What does it take to see entanglement?

arXiv:1602.01907 [quant-ph] arxiv.org/abs/1602.01907

Abstract

Tremendous progress has been realized in quantum optics for engineering and detecting the quantum properties of light. Today, photon pairs are routinely created in entangled states. Entanglement is revealed using single-photon detectors in which a single photon triggers an avalanche current. The resulting signal is then processed and stored in a computer. Here, we propose an approach to get rid of all the electronic devices between the photons and the experimentalist i.e. to use the experimentalist's eye to detect entanglement. We show in particular, that the micro entanglement that is produced by sending a single photon into a beam-splitter can be detected with the eye using the magnifying glass of a displacement in phase space. The feasibility study convincingly demonstrates the possibility to realize the first experiment where entanglement is observed with the eye.

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