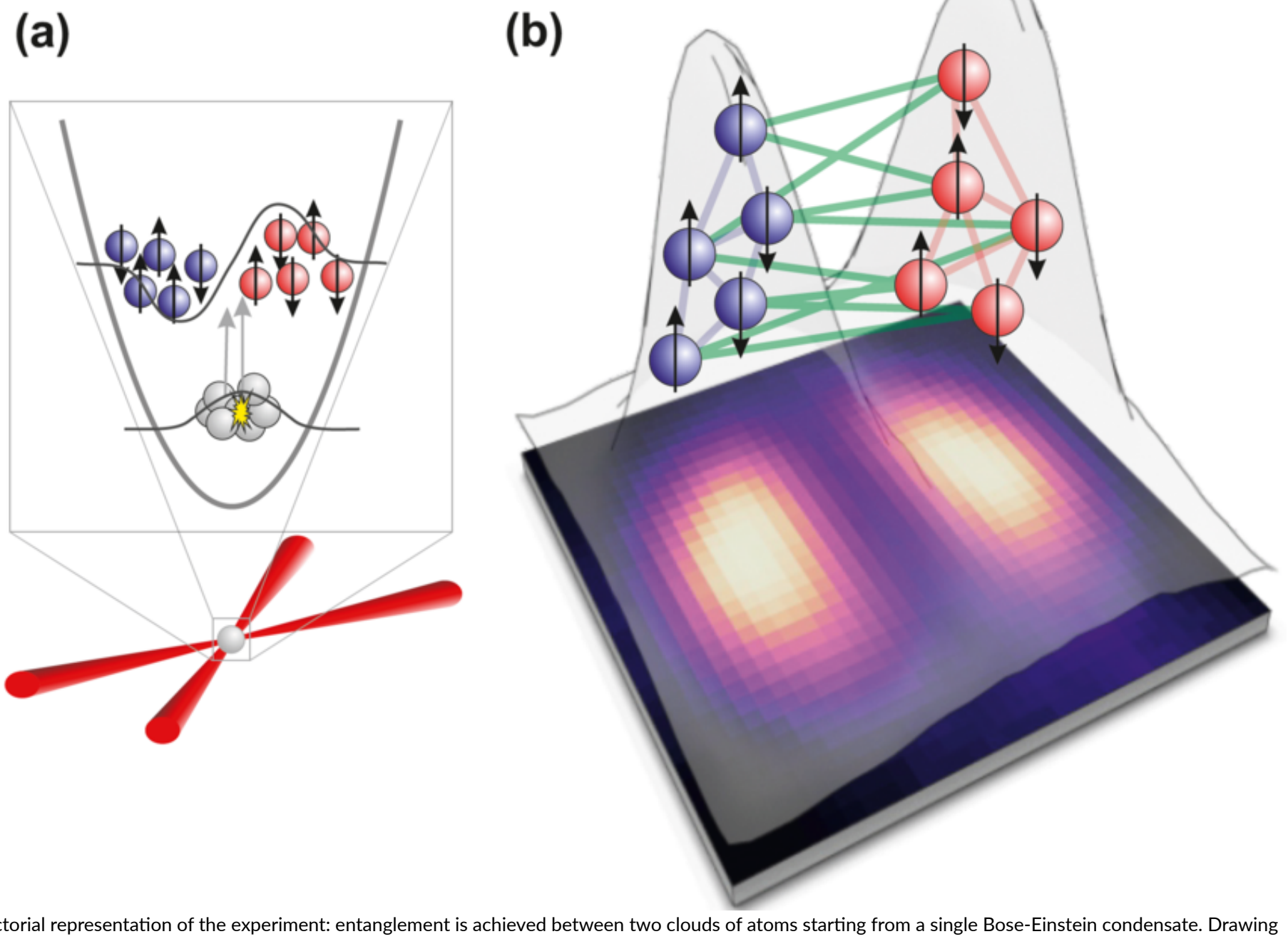
05/22/2018

QUANTUM ENTANGLEMENT ACHIEVED BETWEEN THE TWO CLOUDS OF ATOMS STARTING FROM A SINGLE BOSE-EINSTEIN CONDENSATE

Dr. Giuseppe Vitagliano from the Institute for Quantum Optics and Quantum Information (IQOQI-Vienna) collaborated with the Quantum Information Theory and Quantum Metrology group led by Prof. Geza Toth at the Unversity of the Basque Country, on detecting entanglement in Bose-Einsten condensates.

The scheme has been used in the experiment of Prof. Carsten Klempt at the University of Hannover, where an entangled state between two spatially separated Bose-Einstein condensates has been observed. The results has been recently published in Science [360, 416-418 (2018)] (http://science.sciencemag.org/content/360/6387/416.full).

In the experiment, a highly entangled Dicke state was created in an ultracold atomic cloud. The cloud was placed in a double-well and thus spatially divided in two parts. Measurements of the collective spin on the two wells showed that the two parts, with thousands of atoms each, are entangled.



Pictorial representation of the experiment: entanglement is achieved between two clouds of atoms starting from a single Bose-Einstein condensate. Drawing by: Iagoba Apellaniz, UPV/EHU

The experiment demonstrates that multipartite entanglement of many indistinguishable particles can be converted into bipartite entanglement of distinguishable groups of atoms. This is very relevant, since there are numerous experiments producing highly entangled states in Bose-Einstein condensates, while for certain applications in quantum technologies the distinguishability of the parties is required.

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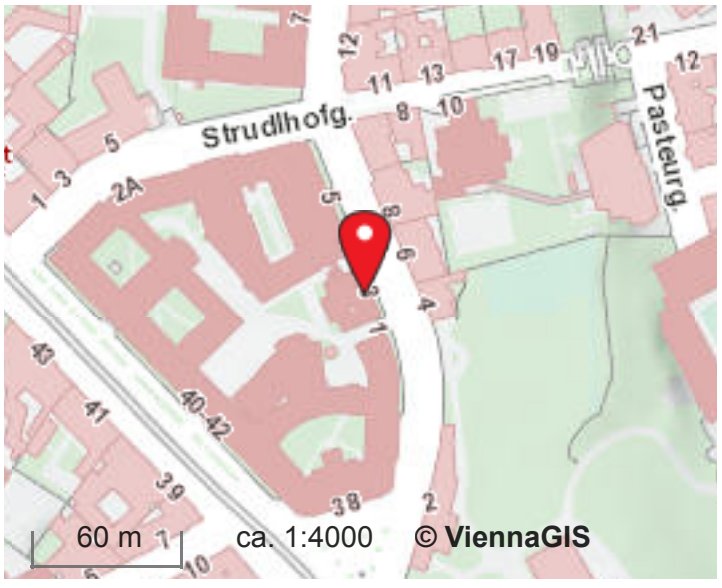

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