

PHD STUDENT POSITION

Vienna Center of Quantum Science and Technology
Group of Anton Zeilinger
University of Vienna and Austrian Academy of Sciences

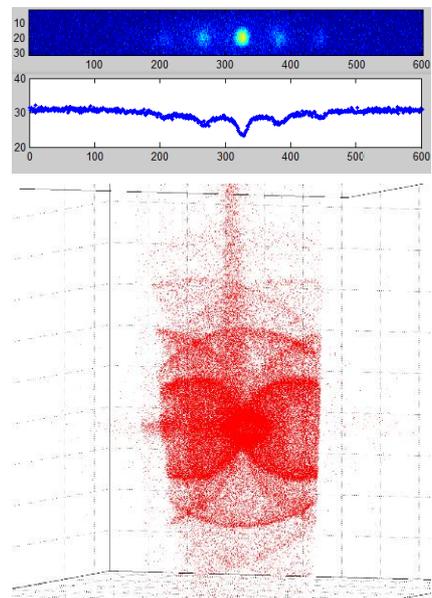
THE POSITION

If you are interested in exploring the **fundamental phenomena of quantum physics**, have a strong background in cold-atom experiments and quantum optics, **Bose-Einstein condensates (BEC)** in particular, and would love to join a young, international and energetic team of bright researchers at the cutting edge of quantum science, **apply now!**

The candidate will be working to do experiments with **novel atom-entangled states** using our **metastable helium BEC experiment** at the Austrian Academy of Science's Institute for Quantum Optics and Quantum Information in Vienna.

THE EXPERIMENT

The goal of our project is to study **momentum entangled states** of neutral helium atoms, for example the **three-dimensional realization of a famous state proposed by Einstein, Podolsky and Rosen (EPR)** in 1935. In the last few years, we have built a **BEC experiment with helium-4***. We are now able to condense atoms either in a magnetic trap or in an optical dipole trap. By using laser pulses in various configurations we introduced collisions between atoms which should lead to atom-atom entangled states. With our position-resolving detection system we can **identify individual atoms** and reconstruct their momentum-space distribution as shown in the picture. The final goal of the experiment is to combine our experience in BEC with the vast experience of our group with entangled photons to ultimately observe **Einstein-Podolsky-Rosen correlations**.*



We expect that the resulting new field will be as rich as the field of entangled photons which has become essential in quantum information. By transferring the interesting phenomena studied there to the atom domain, **new experiments will be possible** due to the much stronger influence of gravity on atoms and the differences between the statistics of fermions and bosons. New possibilities will emerge to create hybrid entangled states between photons and atoms, and to study the interaction of atoms with complex light patterns using spatial light modulators. This will open a novel way to **holography with matter waves**.

REQUIRED QUALIFICATIONS AND COMPETENCIES

Our ideal candidate has a **strong background in cold atom experiments and quantum optics** and is **interested in exploring very fundamental phenomena** and their possible application in quantum computation.

HOW TO APPLY

Expressions of interest or applications with relevant material (CV, list of publications, names of three references) should be sent to Claudia Roithinger at claudia.roithinger@univie.ac.at.

*M. Keller, M. Kotyrba, F. Leupold, M. Singh, M. Ebner and A. Zeilinger, *A Bose-Einstein condensate of metastable helium for quantum correlation experiments*, Phys. Rev. A **90**, 063607 (2014); J. Kofler, M. Singh, M. Ebner, M. Keller, M. Kotyrba and A. Zeilinger, *Einstein-Podolsky-Rosen correlations from colliding Bose-Einstein condensates*, Phys. Rev. A **86**, 032115 (2012).

