

# Researchers demonstrate 'ghost imaging' with atoms

December 1 2016, by James Grubel

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Credit: Australian National University

A team of physicists at ANU have used a technique known as 'ghost imaging' to create an image of an object from atoms that never interact with it.

This is the first time that [ghost imaging](#) has been achieved using [atoms](#), although it has previously been demonstrated with light, leading to

applications being developed for imaging and remote sensing through turbulent environments.

The atom-based result may lead to a new method for quality control of nanoscale manufacturing, including atomic scale 3-D printing.

Lead researcher Associate Professor Andrew Truscott from the ANU Research School of Physics and Engineering (RSPE) said the experiment relied on correlated pairs of atoms. The pairs were separated by around six centimetres and used to generate an image of the ANU logo.

"One atom in each pair was directed towards a mask with the letters 'ANU' cut-out," Associate Professor Truscott said.

"Only atoms that pass through the mask reach a 'bucket' detector placed behind the mask, which records a 'ping' each time an atom hits it. The second atom in the pair records a 'ping' along with the atom's location on a second spatial detector.

"By matching the times of the 'pings' from pairs of atoms we were able to discard all atoms hitting the spatial detector whose partner had not passed through the mask.

"This allowed an image of 'ANU' to be recreated, even though - remarkably - the atoms forming the image on the spatial detector had never interacted with the mask. That's why the image is termed a 'ghost'."

Professor Ken Baldwin, also from the RSPE team, said the research may eventually be used for [quality control](#) in manufacturing microchips or nano devices.

"We might one day be able to detect in real time when a problem occurs

in the manufacturing of a microchip or a nano device," Professor Baldwin said.

Co-author Dr Sean Hodgman said on a fundamental level, the research could also be a precursor to investigating entanglement between massive particles, which could help the development of quantum computation.

"This research could open up techniques to probe quantum entanglement, otherwise known as Einstein's spooky action at a distance," Dr Hodgman said.

**More information:** R. I. Khakimov et al. Ghost imaging with atoms, *Nature* (2016). [DOI: 10.1038/nature20154](https://doi.org/10.1038/nature20154) R. I. Khakimov et al. Ghost imaging with atoms, *Nature* (2016). [DOI: 10.1038/nature20154](https://doi.org/10.1038/nature20154)

Provided by Australian National University

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