

# Measuring atoms for better navigation and mineral detection

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Lasers can trap and cool a gas of atoms can be used to make an ultra-precise measurement device called an atom interferometer. Credit: Pixabay

Better navigation systems and tracking of minerals and water may be the result of a new discovery by physicists studying atom measurement

devices.

University of Queensland PhD candidate Mr Samuel Nolan said the study investigated how to reduce errors in atom interferometers, devices that provide incredibly precise measurements of different physical quantities such as time, electric and magnetic fields, accelerations and rotations.

"Atom interferometers are used in the mining industry to detect what's beneath the ground; at sea to improve navigation; and to track movement of water across the planet," Mr Nolan said.

Mr Nolan worked with Dr Stuart Szigeti, ARC Centre for Excellence for Engineered Quantum Systems, The University of Queensland, and Dr Simon Haine, University of Sussex, to devise a way to decrease errors in atom measurement devices.

The technique provides greater flexibility in designing these [quantum sensors](#) and allows the devices to operate with unprecedented levels of precision.

"The measurement precision of atom interferometers can be boosted by exploiting a weird property of quantum waves called '[quantum entanglement](#)' but so far they can't compete with more conventional precision sensors," he said.

Quantum entanglement is a phenomenon which Einstein famously called "spooky action at a distance".

"The proposed new technique allows [atoms](#) to be counted in a way that is very robust against detection noise, a problem with current devices, and could help to move experimental physics out of the laboratory and into the real world," Mr Nolan said.

**More information:** Samuel P. Nolan et al, Optimal and Robust Quantum Metrology Using Interaction-Based Readouts, *Physical Review Letters* (2017). [DOI: 10.1103/PhysRevLett.119.193601](https://doi.org/10.1103/PhysRevLett.119.193601)

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