

# **A Bose-Einstein condensate has been produced in space for the first time**

October 18 2018, by Bob Yirka

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The payload of the sounding rocket in the integration hall at the European Space and Sounding Rocket Range (Esrange) in Sweden Credit: photo/©: André Wenzlawski, JGU

An international team of researchers has successfully produced a Bose-Einstein condensate (BEC) in space for the first time. In their paper published in the journal *Nature*, the group describes creating a small experimental device that was carried on a rocket into space and the experiments that were conducted during its freefall.

A Bose-Einstein condensate is a state of matter occurring after [gas atoms](#) with very low density are chilled to very near absolute zero and bunch up to form an extremely dense quantum state. Scientists are interested in producing them so that they can test their properties—theory has suggested that they could serve as the basis for highly sensitive sensors. Such super-sensitive sensors could be used to better understand physics phenomena such as gravitational waves. However, producing Bose-Einstein condensates is tricky, because gravity interferes with devices for producing and studying them. The current method involves dropping such devices from towers to allow them to do their work in a zero-gravity environment—but these experiments have just fractions of seconds to operate. Doing these experiments in space would be a much better option due to the microgravity environment.

Realizing the potential of a space-based platform for conducting BEC research, the U.S. launched the Cold Atom Laboratory last May, though it is not yet fully functional. In the interim, the researchers with this new effort created a tiny device capable of producing a BEC and conducting a host of experiments on it, which they put aboard a rocket and launched



into space.



Payload of the sounding rocket and all those involved in the undertaking, among them scientists of the MAIUS-1 project, employees of the German Aerospace Center, and employees of the Esrange rocket launch site Credit: photo/©: Thomas Schleuss, DLR

The device consisted of a capsule containing a chip holding a group of rubidium-87 atoms, electronics, some lasers and a power source. It was activated once the rocket reached an altitude of 243 km, producing a BEC in just 1.6 seconds. Once the BEC was produced, 110 preprogrammed experiments were carried out in the six minutes it took the rocket to fall back to Earth.

The BEC produced by the team was the first ever produced in space and marks the start of a new era in BEC research efforts.

**More information:** Dennis Becker et al. Space-borne Bose–Einstein condensation for precision interferometry, *Nature* (2018). [DOI: 10.1038/s41586-018-0605-1](https://doi.org/10.1038/s41586-018-0605-1)

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