

Researchers improve the measurement of a fundamental physical constant

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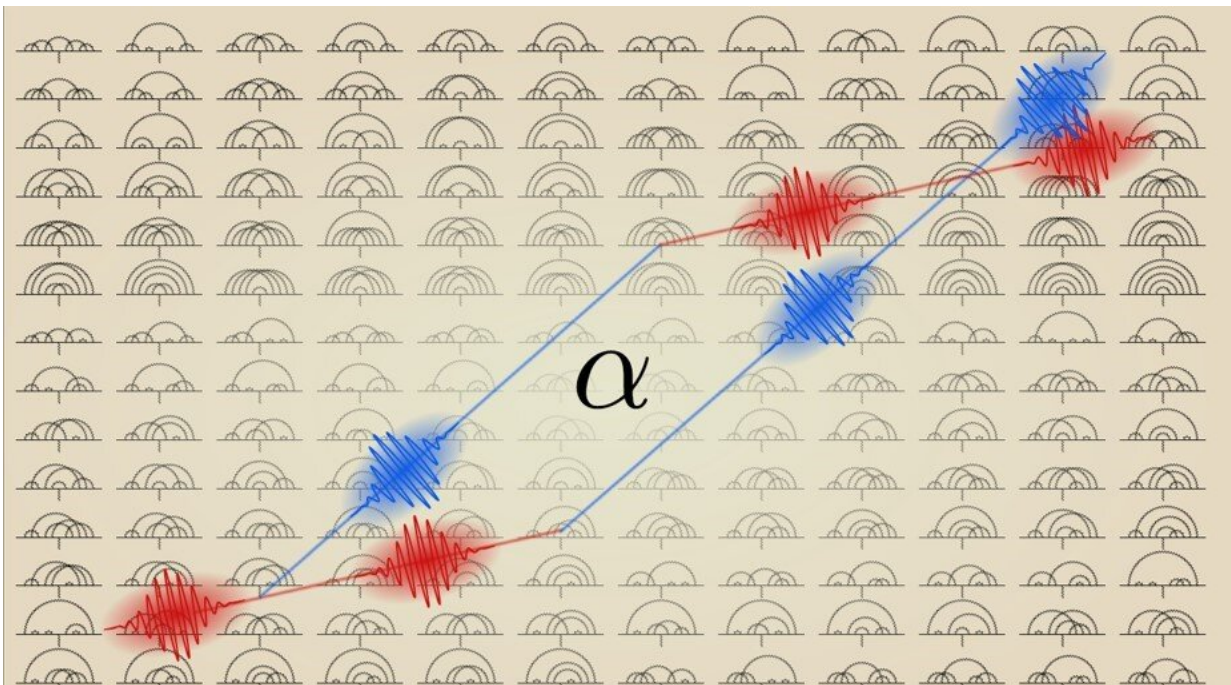


Illustration of the experimental measurement of the fine-structure constant. The background patterns in the image represent the actual Feynman diagrams used to help calculate the theoretical value of the electron magnetic moment anomaly (calculated using the fine-structure constant, among others). The scheme of the atom interferometer used for measuring the recoil velocity is represented in colour. Credit: Pierre Cladé, Saïda Guellati-Khélifa et Tatsumi Aoyama

The validation and application of theories in physics require the

measurement of universal values known as fundamental constants.

A team of French researchers has just conducted the most [accurate measurement](#) to date of the fine-structure constant, which characterizes the strength of interaction between light and charged [elementary particles](#), such as electrons.

This value has just been determined with an accuracy of 11 significant digits; improving the precision of the previous measurement by a factor of 3.

The scientists achieved such precision by enhancing their experimental set-up, in an effort to reduce inaccuracies and to control effects that can create perturbations of the measurement.

The experiment involves cold rubidium atoms with a temperature approaching absolute zero.

When they absorb photons, these atoms recoil at a velocity that depends on their mass. The highly precise measurement of this phenomenon helps to improve the knowledge of the fine-structure constant.

These results, which will appear in *Nature* on 3 December, open new prospects for testing the Standard Model's theoretical predictions.

The use of more accurate constants can help to answer fundamental questions, such as the origin of dark matter in the universe.

More information: Determination of the fine-structure constant with an accuracy of 81 parts per trillion, *Nature* (2020). [DOI: 10.1038/s41586-020-2964-7](#), www.nature.com/articles/s41586-020-2964-7

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