



## RESEARCH

### RELATIVITY MEASUREMENTS WITH PRECISION BEYOND THE LIMITS

From quantum physics arrive two results that exceed the limits reached so far in sensitivity and precision in the measurements of the phenomena related to General Relativity and to gravitational physics. The results, published in Physical Review Letters were obtained in two atomic interferometry experiments by a team of researchers from the University of Florence and of INFN. At the base of the two experiments are atomic interferometry apparatuses, built in Florence, and based on the use of "atomic fountains" created with a laser.

In the first experiment, carried out within the scope of the MAGIA Advanced project, the researchers developed a method that will allow testing of the validity of Einstein's equivalence principle with unprecedented accuracy. By cooling the rubidium atoms down to almost absolute zero with a laser and launching them upwards in a vacuum system, the conditions to measure the fall of weights were created by eliminating the effects due to the variation of the earth's gravity, which influence any classical measurement.

Then, using strontium atoms, the researchers built a second experiment that proved to be valid for future measurement experiments, on a quantum scale, of low-frequency gravitational waves, with even higher sensitivities than those obtained by the LIGO and VIRGO interferometers. This second experiment thus opens the way to the construction of high precision atomic interferometry instruments to study gravitational waves in a region of frequency that cannot be observed with current terrestrial optical interferometers, instruments also useful for future spatial experiments in collaboration with the European Space Agency (ESA) and the Italian Space Agency (ASI). ■