Einstein’s Universe: from neutron stars to black holes

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This year, we celebrate the centenary of Einstein’s theory of general relativity. When the theory was conceived, the number of experimental tests to confront the theory with was limited. Since then we have come a long way. In particular astronomical observations provide precision tests that were inconceivable even 50 years ago. We use neutron stars observable as pulsars to provide the most precise tests for strongly self-gravitating bodies, to prove that gravitational waves exist or to measure the effects of curvature of space time. We also attempt to determine the properties of black holes, such as their mass and spin to test the description of black holes within general relativity. One of the highlights will be an image of the “shadow" of the supermassive black hole in the centre of our Milky Way. Soon we also expect that gravitational wave detectors open up a new window to Einstein’s Universe. In all cases, neutron stars or black holes play a crucial role. In this talk I will review some of the current and future tests of general relativity and compare those results with tests of alternative theories.