Fundamental physics in the gravitational-wave era

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We celebrate a decade of gravitational wave astronomy. One of the most remarkable achievements concerns tests of General Relativity and of the nature of compact objects. Gravitational collapse in Einstein's theory leads to black holes, leaving behind a geometry with light rings, ergoregions and horizons. These peculiarities are responsible for uniqueness properties and energy extraction mechanisms that turn black holes into ideal laboratories of strong gravity, of particle physics (yes!) and of possible quantum-gravity effects. I will review some of the things we learned during the last ten years.