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The Nature of the Quark-Gluon-Plasma

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The Quark-Gluon-Plasma (QGP) is a highly excited, strongly interacting, hot and dense state of matter. Its degrees of freedom are quarks and gluons which are the basic constituents of quantum chromodynamics (QCD), one of the four fundamental forces of nature. It is believed that shortly after the creation of the universe in the Big Bang all matter was in the QGP state. Due to the rapid expansion and cooling of the Universe, this plasma underwent a transition to form hadrons (bound states of quarks and gluons), which constitute the building blocks of matter as we know it today. The investigation of QGP properties and the nature of the QGP to hadron transition will yield important novel insights into the development of the early universe and the behavior of QCD under extreme conditions. More than a thousand experimentalists are working to recreate this highly excited state of primordial matter under controlled laboratory conditions by colliding two heavy atomic nuclei at relativistic energies and to study its properties. These experiments are currently underway at the Relativistic Heavy-Ion Collider (RHIC) at Brookhaven National Laboratory. Data from the first years of RHIC operations have yielded many interesting and sometimes surprising results which have not yet been fully evaluated or understood. In my talk I will highlight some of the most exciting discoveries made at RHIC and discuss recent theoretical efforts to understand the nature and properties of the QGP created there.