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Ultra-relativistic heavy ion physics highlights –past, present and future

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Ultra-relativistic collisions of heavy nuclei at the Large Hadron Collider (LHC) at CERN in Geneva (Switzerland) and the Relativistic Heavy Ion Collider (RHIC) in New York (US) create sufficiently high temperatures that nuclear matter melts into a "soup"of quarks and gluons called the quark-gluon plasma (QGP). Thousands of particles and anti-particles are created in a single event with temperatures reaching T ˜ 2 x 10**12 K, some 200,000 times hotter than the sun's core and expected only within the first microseconds after the Big Bang. Normal hadrons cannot exist at these temperatures. The soup is observed to flow easily, with extremely low viscosity, suggesting a nearly perfect liquid of quarks and gluons. New results have extended the study of the QGP to higher temperatures and penetrating probes. Measurements of very energetic jets, extremely large transverse momentum particles, and heavy flavors indicate a very dense and highly interacting system that is opaque to energetic probes. I will present a motivation for physics in this field, an overview and interpretation of the results, and the elucidate the "big questions"remaining to be answered. I will also offer a perspective on the future of the field as it is presently envisioned.

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