KMI Colloquium

Reproducing Big Bang of the Universe in an Experimental Hall

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Abstract:

The Big Bang Theory is the leading explanation about how the universe began. At its simplest, the theory says the universe as we know it started with a small singularity, then inflated over the next 13.7 billion years to the cosmos that we know today. As a consequence of the vast expansion of extremely condensed material, the universe cooled down and the matter formed.

Believe it or not, human beings are brave enough to reproduce the extreme dense material phase of the big bang on the earth using high energy heavy ion collider accelerators. In these heavy-ion collisions the hundreds of protons and neutrons in two such nuclei smash into one another at energies of upwards of a few trillion electronvolts each. This forms a miniscule fireball in which everything “melts” into a so called “quark-gluon plasma (QGP)”. This extremely high temperature and density state of matter is considered to be existed around the phase of 1 micro second after the big bang.

At the frontier of the QGP research, the boundary conditions to form quark-gluon plasma have been intensely studied. One of open questions as of now is how many nucleons are needed to form the QGP. I will introduce experimental observations of the quark-gluon plasma in Relativistic Heavy Ion Collider (RHIC) and Large Hadron Collider (LHC) and discuss if the QGP can be formed even with a proton-proton colliding.