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Mapping the Little Bangs Through Energy Density and Temperature Fluctuations

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Heavy-ion collisions at relativistic
energies, which are accessible at the Relativistic Heavy Ion
Collider (RHIC) and the Large Hadron Collider (LHC), are often
referred to as little bangs.
Experiments at these energies probe the conditions which
prevail at freeze-out, and often it is not possible to
define the correct equation-of-state (EoS) and the conditions
at the initial stages of the collision.
By employing hydrodynamic evolution of the fireball [1] created in the
collisions, we have
generated maps of the energy density (ϵ) and temperature
(T) of the system
throughout its evolution. With the help of the maps, we obtain
time evolution of the fluctuations in ϵ and T.
We have shown for the first time that
the method of interpolation of fluctuations obtained from the maps
can provide a powerful technique in looking back at the initial stages of
the heavy-ion collisions.

In case of cosmic microwave background radiation (CMBR),
temperature maps of the sky [2],
made by scanning in θ-ϕ bins, provide vital information
regarding the age and composition of the Universe, galaxy formation,
expansion rate, etc. This is possible by analyzing the map to
extract temperature fluctuations and making power spectrum.

For heavy-ion collisions, we
propose to make temperature maps in
rapidity and azimuthal angle (y-ϕ). This is demonstrated by using the
AMPT event generator. By making correspondence
with the evolution of fluctuations from hydrodynamics,
vital information regarding the fireball can be obtained at very early stage
and throughout the evolution of the system [3].
We will present this new method, first results and make the proposal
for its application to experimental data at RHIC and LHC.

[1] H. Holopainen, H. Niemiand and K.J. Eskola, Phys. Rev.C 83, 034901(2011).

[2] C. L. Bennett et al. [WMAP Collaboration], Astrophys. J. Suppl. 148, 1 (2003); E. Komatsu et al. [WMAP Collaboration], arXiv:0803.0547 [astro-ph].

[3] S. Basu, R. Chatterjee, B.K. Nandi and T.K. Nayak (in preparation).

On behalf of collaboration:

None

Author: BASU, Sumit (Department of Atomic Energy (IN))

Co-authors: NANDI, Basanta Kumar (IIT- Indian Institute of Technology (IN)); CHATTERJEE, Rupa; NAYAK, Tapan (Department of Atomic Energy (IN))

Presenter: BASU, Sumit (Department of Atomic Energy (IN))

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