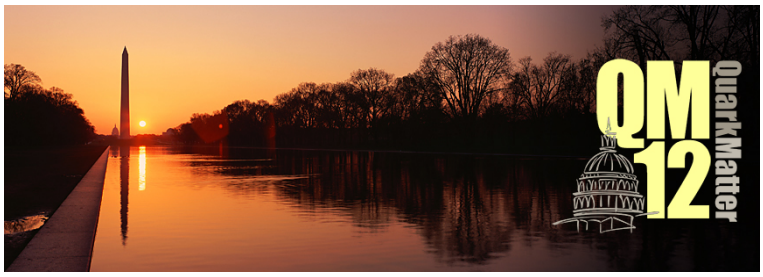

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Using CMBR tools to study flow anisotropies in relativistic heavy ion collisions

Thursday, 16 August 2012 16:00 (2 hours)

We study the interesting similarities between the physics of cosmic microwave background radiation anisotropies and the flow anisotropies in relativistic heavy ion collision experiments. Further we explore how the techniques in CMBR analysis could be utilized in studying the flow anisotropies in RHICE.

We argue that the initial state fluctuations of the matter formed in heavy ion collisions have similar properties as the fluctuations in the early universe generated by the inflaton field, and by studying the flow coeffecients (a plot of v_n vs. n) we can obtain valuable information about the nature and evolution of these fluctuations. We also study the effect of magnetic field on flow.
In the presence of magnetic field plasma develops three acoustic modes. It is known in literature that this distorts the CMB acoustic peaks. We show that flow coefficients in relativistic heavy ion collisions can be significantly affected by these effects where a a strong magnetic field is known to be present in the initial stages (of non-central collisions) and is expected to survive due to strong induced fields in the conducting plasma. This raises the possibility whether a larger value of η/s can be accommodated by RHIC data. We also show that flow anisotropies in relativistic heavy-ion collisions can be analyzed using a certain technique of shape analysis of excursion sets recently proposed by us for CMBR fluctuations to investigate anisotropic expansion history of the universe. The technique analyzes shapes
(sizes) of patches above (below) certain threshold value for transverse energy/particle number fluctuations (the excursion sets) as a function of the azimuthal angle and rapidity. This provides an alternative way to identify the event plane in an event.

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