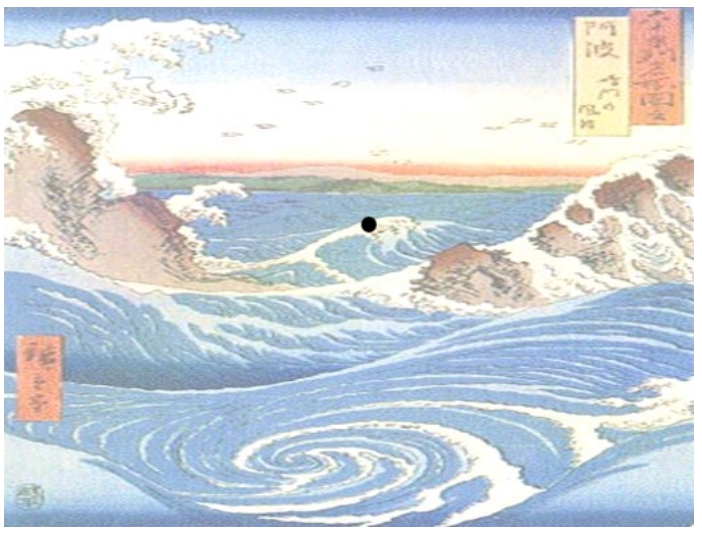
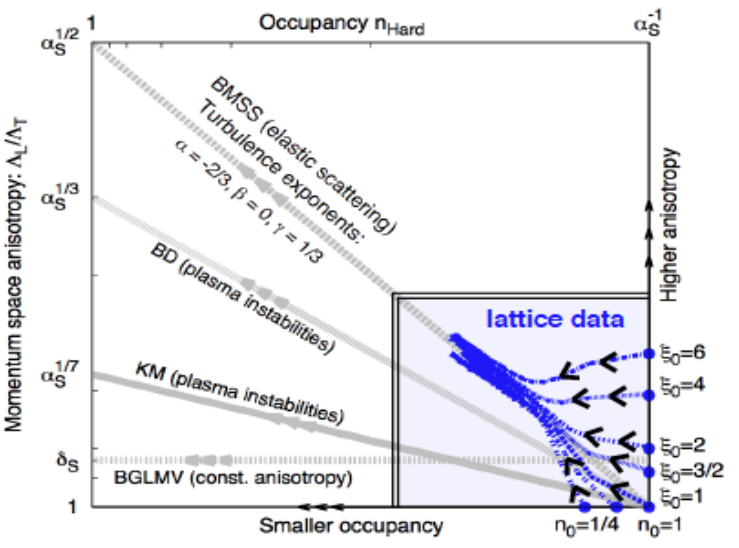
DESY
Physics Seminar

How hot glue becomes a nearly perfect fluid: the problem of thermalization in ultra-relativistic heavy ion collisions.

Raju Venugopalan (BNL/Heidelberg)

Tuesday, 05 April 2016, 16:45 h, DESY Auditorium





The hottest matter on earth is created when gluons (with a sprinkling of quark-antiquark pairs) are liberated in the collisions of ultra-relativistic heavy ions at the RHIC and LHC colliders. A fully *ab initio* understanding of how this strongly correlated gluon matter thermalizes and flows is lacking. We review progress towards solving this problem and discuss surprising recent numerical results – in particular the discovery of a universal non-thermal fixed point (typical of weak wave turbulence) in an expanding non-Abelian plasma. Remarkably, the self-similar behavior of this fluid is identical to those of over-occupied N component self-interacting scalar theories that model, for instance, the behavior of cold atomic gases. We discuss possible insights into the hottest fluids produced on earth obtained from the coldest fluids – in particular, the possible formation of transient Bose-Einstein condensates. We also discuss another recent development: a computation of the off-equilibrium sphaleron transition rate in the over occupied plasma, and its implications. Our discussion will be grounded in the empirical constraints from the heavy-ion experiments. As an example, time permitting, we will outline how rare high multiplicity proton-nucleus collisions further test the “unreasonable effectiveness of hydrodynamics” as a description of the tiny and ephemeral droplets of quark-gluon matter created at RHIC and the LHC.

- **Coffee, tea and cookies will be served at 16:30h**
- **After the seminar there is a chance for private discussions with the speaker over wine and pretzels**

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