Contribution ID: **6** Type: **Plenary Talk**

MAGIC - how Matter's extreme phases can be revealed in Gravitational wave observations and in relativistic heavy Ion Collision experiments

Wednesday, 5 December 2018 17:00 (45 minutes)

This talk combines a survey of our recent advancements in two rather distinct fields, which reveal - on first sight - a surprising similarity of both, namely relativistic collisions of nuclei and of neutron stars.

Recently, the group at FiAS and at Goethe University discovered that the emitted gravitational waves, as predicted from general relativistic magneto- hydrodynamics from binary neutron star merger - calculations, are extremely sensitive to the appearance of quark matter and the stiffnes of the equation of state of QCD Matter in the inner cores of the two colliding Neutron Stars, as also in their gravitational collapse to one black hole. This is a new observable messenger from outer space, which does provide direct signals for the phase structure of strongly interacting QCD matter at high baryon density and high temperature.

Those astrophysically created extremes of thermodynamics do match , to within 20% , the values of temperatures which we find in relativistic hydrodynamics and transport theory of heavy ion collisions at the existing laboratories like LHC, SpS at Cern, RHIC at Brookhaven, and HaDes - SiS18 at GSi and at the NICA and FAIR accelerators under construction, if though at quite different rapidity windows, impact parameters and bombarding energies of the heavy nuclear systems.

We demonstrate how the gravitational wave signals from future advanced LIGO-Virgo - to radiowave signals from SKA-events can be combined with the high multiplicity fluctuation - and flow measurements in heavy ion detectors in the lab to pin down the EoS and the phase structure of dense matter.

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