A Proposal for the ECT Workshop in Spring 2004

Tracing the Onset of Deconfinement in Nucleus–Nucleus Collisions

1. Title: Tracing the Onset Deconfinement in Nucleus–Nucleus Collisions

2. Organizers:

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3. Suggested dates of the workshop:
arrival on 25.06 (Friday),
workshop: 26.06 (Saturday) – 1.07 (Thursday)

4. A scientific proposal:

The primary goal of the high energy heavy ion program has been production and study of the deconfined phase of QCD, the Quark-Gluon-Plasma. Results obtained at high energy SPS runs and recent ones from RHIC suggest that such a form of matter seems to be produced at these energies. Thus now the key issue is a search for the hypothetical onset of deconfinement by study heavy ion collisions at low SPS energies. This was the main motivation for the energy scan program started in 1997 at the CERN SPS. Another reason the low energy SPS region is so interesting is the high baryonic density, absent at RHIC. New phenomena related with the QCD tricritical point and the proximity of the color superconductivity phase may be found in this region. The recently approved dedicated facility at GSI will focus on these issues.

In fact, recent results from the energy scan program at the CERN SPS are consistent with the hypothesis that the onset of deconfined matter production is at the low SPS energies, around 30 A·GeV. This conclusion is reached based on the observation of the anomalies in the energy dependence of hadron production: the strangeness and pions yields as well as the transverse mass spectra of kaons. Energy dependence of numerous other observables is under experimental and theoretical studies. These are in particular event–by–event fluctuations, anisotropic flow and two–pion correlations.

The main goals of this workshop are:

- present and discuss new ideas related with the observation of the onset of deconfinement in nucleus–nucleus collisions and the effects related to the high baryonic density reachable in experiments,
- present and discuss directions of future experimental studies, in particular: heavy ion program at the GSI SIS200, a possible energy scan program with light ions at the CERN SPS and a possible extension of the BNL RHIC program to lighter ions and lower energies.
- review the most recent experimental data on energy dependence of particle production in nuclear collisions (SIS, AGS, SPS, RHIC),
- discuss current experimental status of already observed hypothetical signals of deconfinement: energy dependence of pion and strangeness yields as well as of the transverse spectra of kaons,

- discuss current theoretical status of these signals,
- discuss experimental and theoretical status of expected but not observed signals of deconfinement like energy dependence of event–by–event fluctuations, anisotropic flow and two–pion correlations,

5. An outline of a program:

Experimental Results:

1. new experimental results from SIS
2. new experimental results from AGS
3. new experimental results from SPS
4. new experimental results from RHIC
5. energy dependence of pion production
6. energy dependence of strangeness production
7. energy dependence of transverse mass spectra of hadrons
8. energy dependence of event-by-event fluctuations
9. energy dependence of two pion correlations
10. energy dependence of anisotropic flow
11. experimental status of charmonium production

Future Experiments:

1. a new experimental facility at GSI
2. energy scan with light ions at the SPS
3. low energies and lighter nuclei at RHIC

Theory:

1. new phenomena in the high baryon density regime
2. the Equation of State, viscosity and the space-time evolution of nucleus-nucleus collisions (initial conditions, hydro, phase transitions)
3. energy dependence of hadron production and deconfinement in statistical approach

4. energy dependence of hadron production in gluon saturation models
5. energy dependence of hadron production in the hadron gas model
6. charmonium production in nuclear collisions
7. energy dependence of hadron production in string-hadronic models

6. Key participants:

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