

## Preface

We present the Proceedings of the 6<sup>th</sup> International Conference on “Critical Point and Onset of Deconfinement”, which took place at the Joint Institute for Nuclear Research in Dubna (Russia) in the period August 23-28, 2010, as part of a series of meetings that started in 2004 with a workshop at the ECT\* in Trento (Italy). Subsequent meetings were held at the University of Bergen (Norway) in 2005 , at the Galileo Galilei Institute in Florence (Italy) in 2006, at GSI Darmstadt (Germany) in 2007 and at the Brookhaven National Laboratory (USA) in 2009. The next one will take place at Wuhan (China) in November 2011.

It was the first time that Dubna got elected as a site for such a prestigious meeting, ranked in line with the world renowned conference series devoted to the search for the quark-gluon plasma: ”Quark Matter” and ”Strange Quark Matter”. The investigation of the properties of this elusive phase of matter, which dominated our universe a few microseconds after the big bang and eventually constitutes the cores of neutron stars, is the key objective of multi-national research programmes at the relativistic heavy-ion accelerator facilities of the Brookhaven National Laboratory (BNL) in the USA and the European Centre for Nuclear Research (CERN).

While these facilities presently aim at recreating the big bang conditions with approximate matter-antimatter symmetry at highest temperatures, experiments of the third generation are being prepared to probe the state of matter at highest compression, similar to the state in neutron star interiors: the CBM @ FAIR experiment in Darmstadt, Germany and the NICA-MPD experiment at JINR.

The JINR plan for constructing NICA as a competitive heavy-ion collider facility is the main reason why the community decided to bring about 100 leading experts in the quark matter research and more than 60 young scientists to Dubna this year, in order to discuss the status and the challenges of this modern field of research. The focus of the conference as well as the lectures of the summer school is on the fantastic idea that a critical point or even a triple point could exist in the phase diagram of strongly interacting matter. Like the triple point of water at zero degree Celsius, where the liquid, vapour and ice phases of matter coexist, forms the calibration point of our temperature scale - a triple point for strongly interacting matter would be a landmark for calibrating our understanding of extension of Quantum Chromodynamics (QCD) as the fundamental theory for strong forces to the case of extreme conditions. Heavy-ion beam energy scan programs are the experimental tool for finding signatures of phase transitions and eventually of the critical point or the triple point of QCD, if these exist. Such studies are formulated in the road map of the future development of the JINR basic facilities and have been discussed during the conference and the 5th Roundtable workshop

”Physics at NICA” as a satellite meeting to this conference.

All big experiments relevant for this research were represented at CPOD 2010 and gave plenary talks. Among them the NA61 experiment at CERN with its spokesperson Marek Gazdzicki (Frankfurt & Kielce), one of the founding fathers of this conference series; the HADES experiment at GSI which is planned to be extended to higher energies and run together with the CBM experiment at the FAIR facility. Particularly interesting for the NICA-MPD programme presented by Vladimir Kekelidze and Igor Meshkov are the results and the experience with the low-energy collision program at RHIC, being also a collider experiment which should have partial overlap with and be complemented towards lower energies by NICA, as was underlined by Nu Xu (Berkeley) and Gazyna Odyniec (Berkeley).

Highlights from the theoretical frontier research on the QCD phase diagram were the brainstorming discussions about the possibility of a ”quarkyonic phase” (Glozman, Kojo, Sasaki) characterized by chiral symmetry and confinement, as well as the ”chiral magnetic effect” (Toneev, Voloshin), which was recently generalized to the notion of a ”chiral vortical effect” by Rogachevsky, Sorin and Teryaev (JINR).

One of the important prerequisites for the success of the CPOD 2010 conference together with its satellite meetings was the substantial financial support from the JINR, the Russian Fund for Fundamental Investigations, the Dynastia Foundation, the European Physical Society, the Heisenberg-Landau programme of the BMBF

(Germany) and in particular the German Helmholtz Association with its Helmholtz International Center (HIC) for FAIR in Frankfurt and the FAIR - Russia Research Centre (FRRC) in Moscow. The other was the energy and initiative of the team of local organizers at JINR.

We hope that the reader of these Proceedings will get a vivid impression about the scientific work presented and discussed at the CPOD 2010 conference which has underlined that the JINR Dubna with its NICA/MPD project can play a decisive role in both the canon of experimental programmes with heavy-ion beams as well as for theoretical research in investigating the QCD phase diagram and critical phenomena in strongly interacting matter.

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