

University of Wrocław, Poland



Founded in 1703, 9 Nobel prize winners

<http://www.uni.wroc.pl>



International Conference “Critical Point and Onset of Deconfinement”
University of Wroclaw, May 29 – June 4, 2016

Division: Theory of Elementary Particles

Staff:

prof. dr hab. Krzysztof Redlich (head)
prof. dr hab. David Blaschke
prof. dr hab. Ludwik Turko
dr hab. Chihiro Sasaki, prof. Uwr
dr hab. Tobias Fischer
dr Pok Man Lo

PhD students:

Dipl.-phys. Niels-Uwe Bastian
Dipl.-phys. Diana Alvear Terrero
mgr Udit Shukla
mgr Mateusz Cierniak
mgr Łukasz Juchnowski
mgr Michał Marczenko

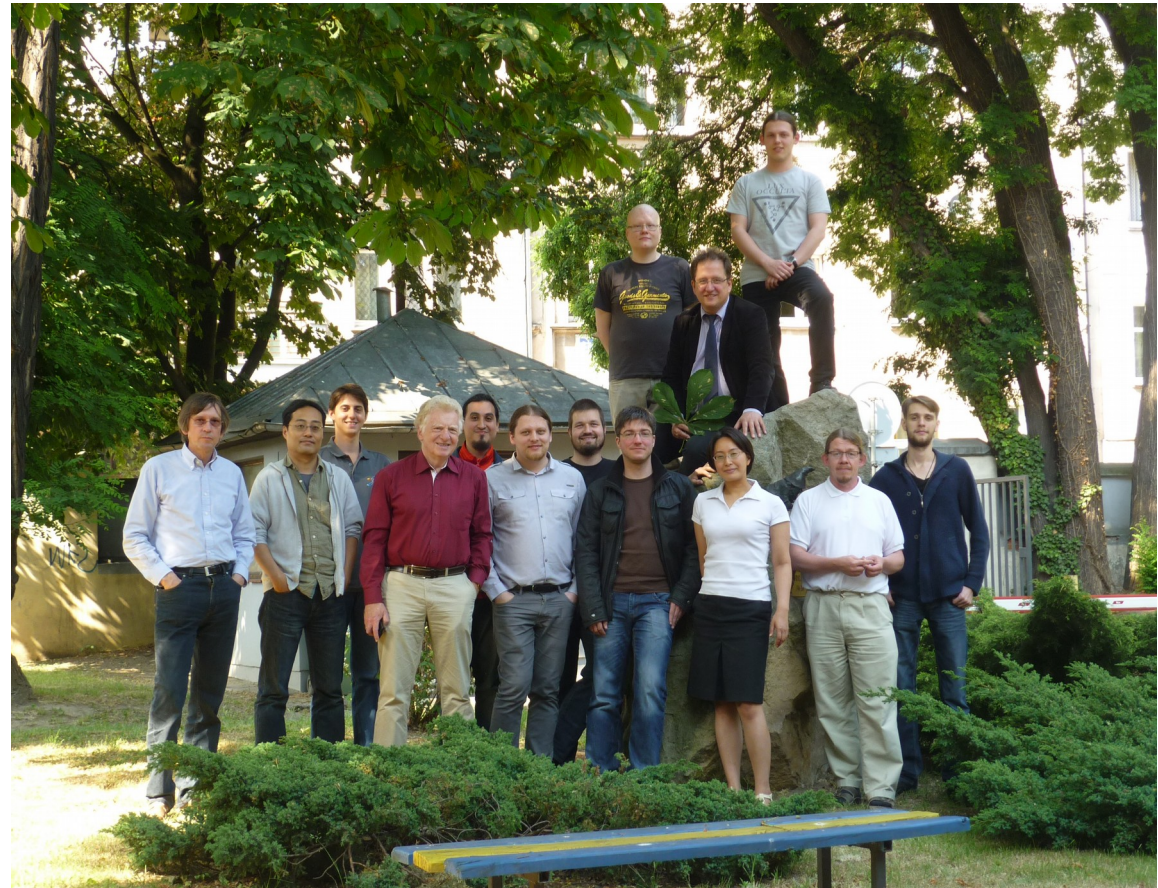
Master students:

Mateusz Halupka
Maciej Lewicki
Michał Naskręt
Michał Szymański

+many visitors from 4 continents

Current NCN research projects:

Maestro (2), Opus (4), Sonata (1)

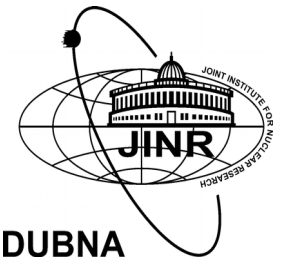
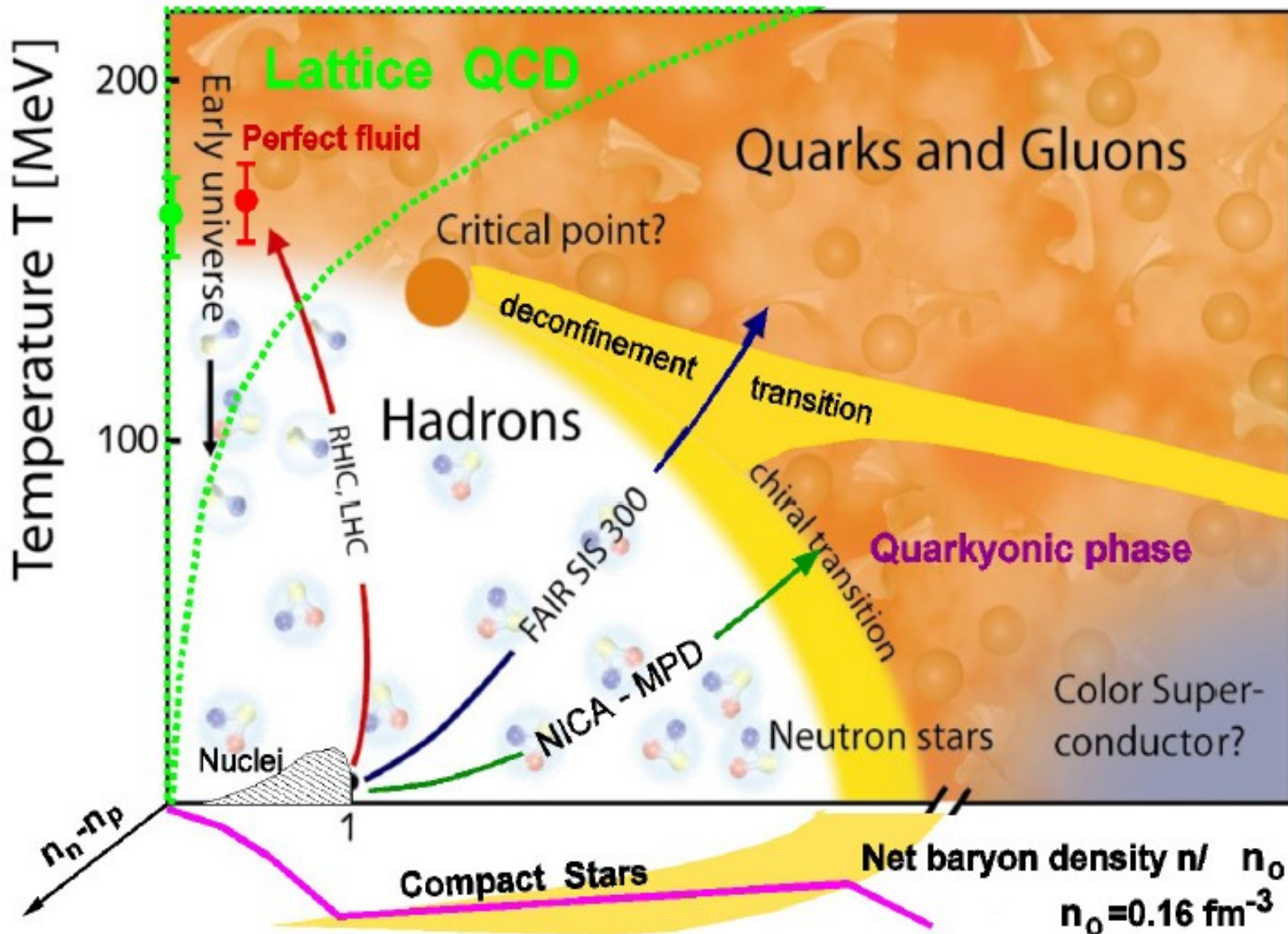


Main research topics:

- Quantum field theory under extreme conditions
- Physics of ultra-relativistic heavy-ion collisions
- Physics of compact stars and supernovae

Publications in 2010-2015: 241 (98 with ALICE Collab.)

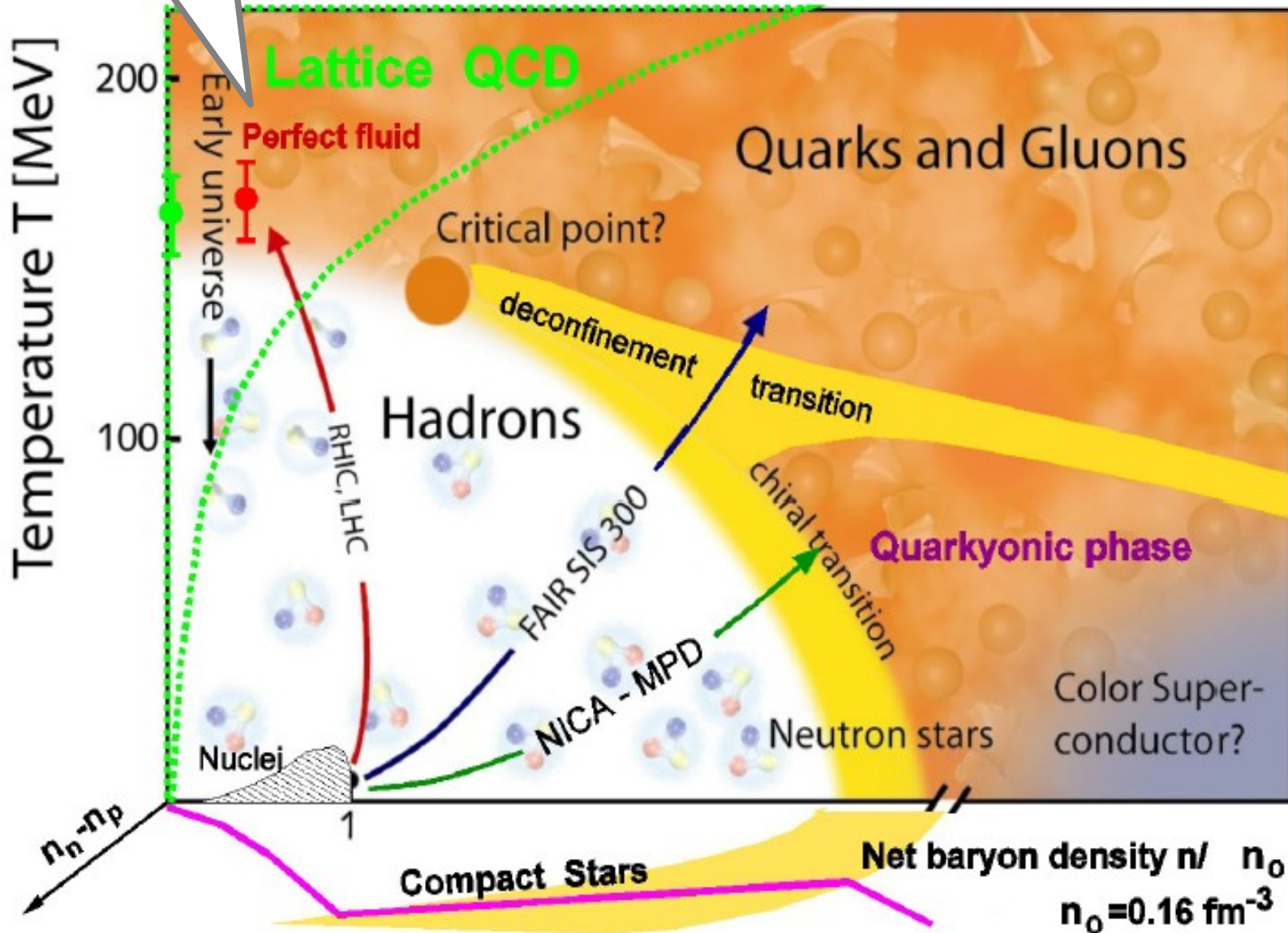
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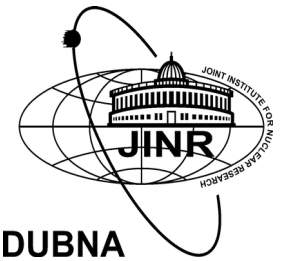
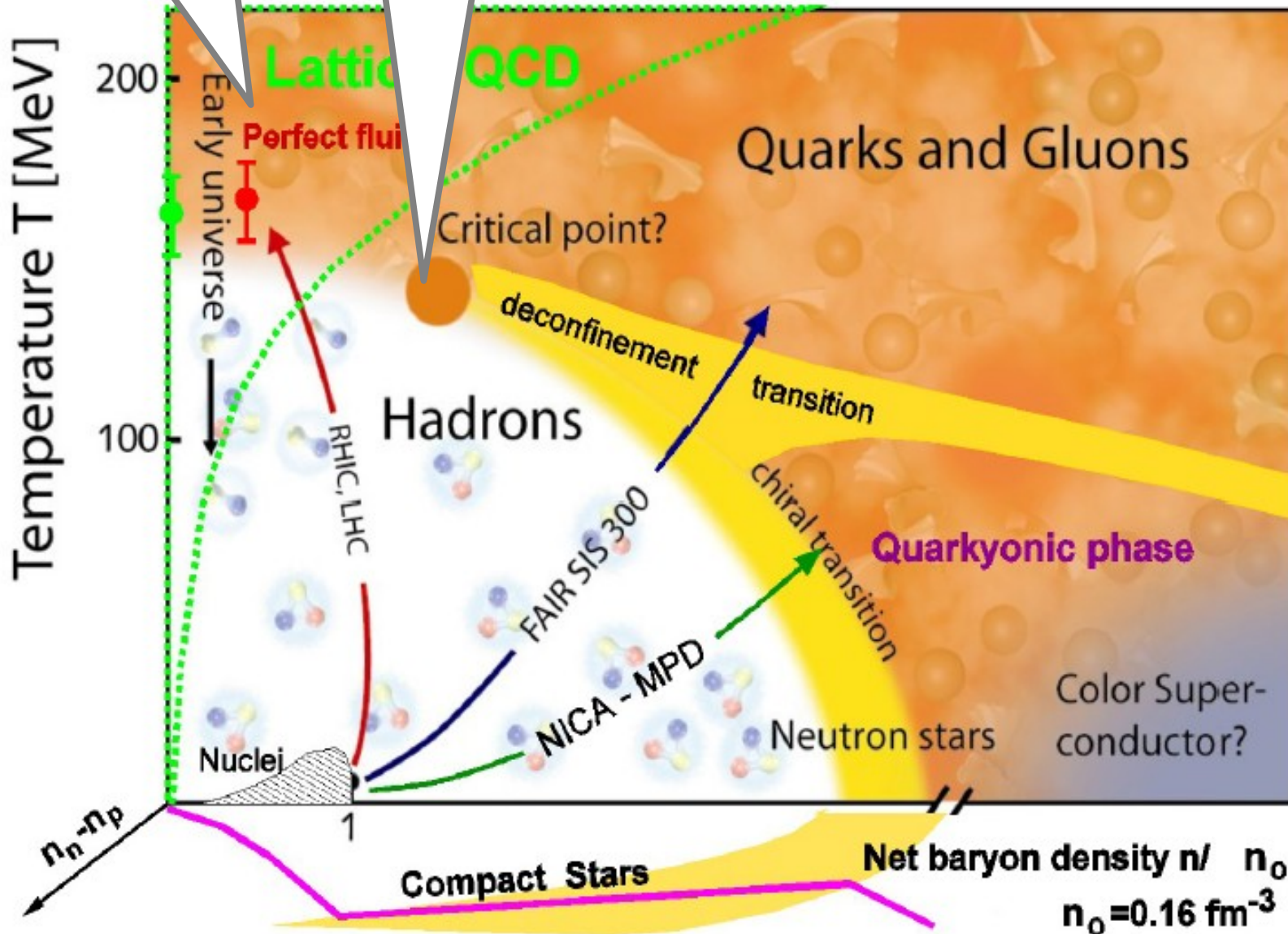
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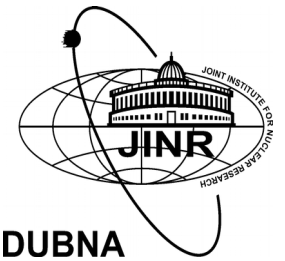
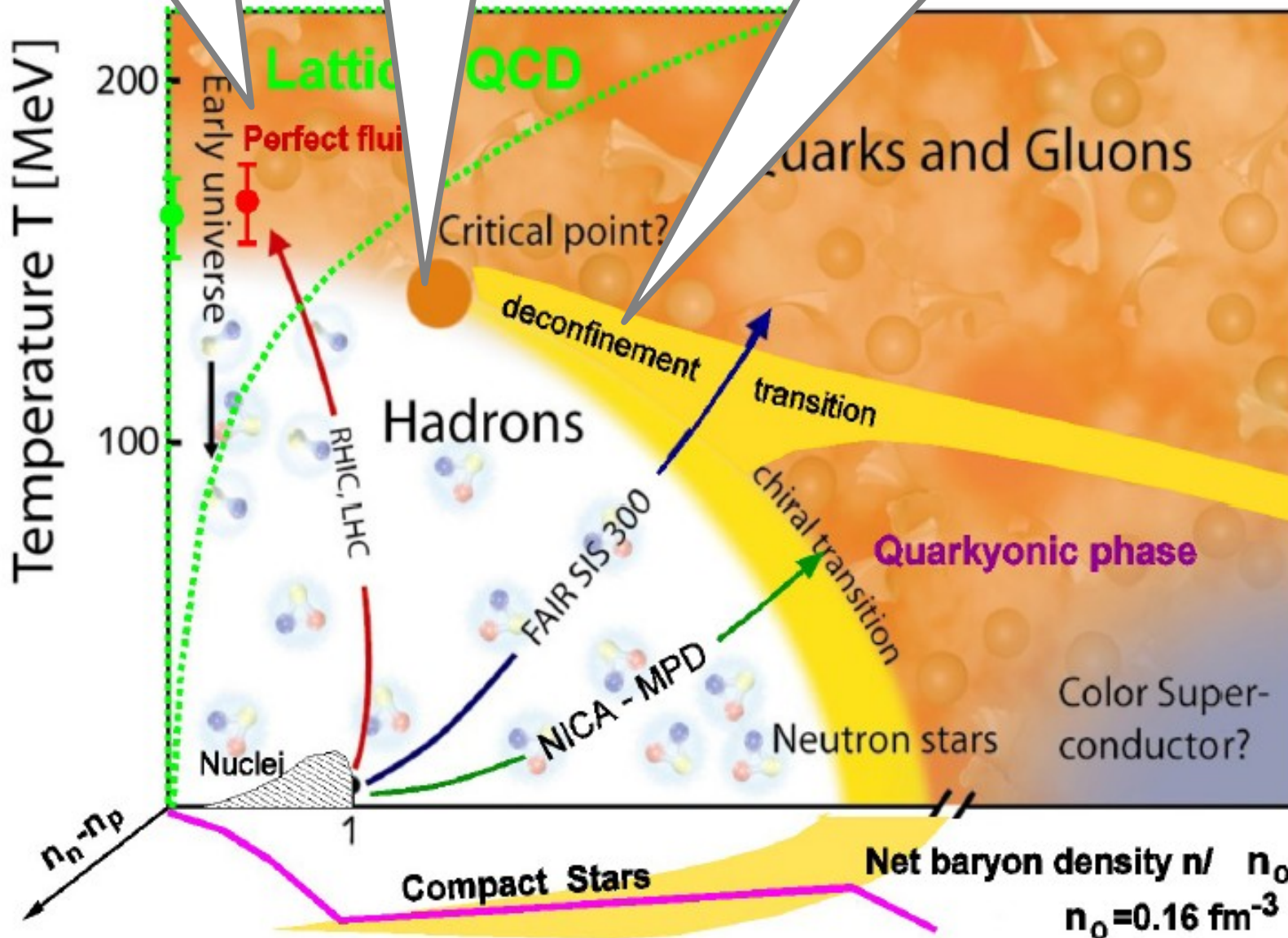
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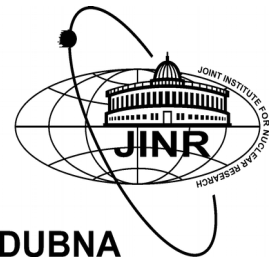
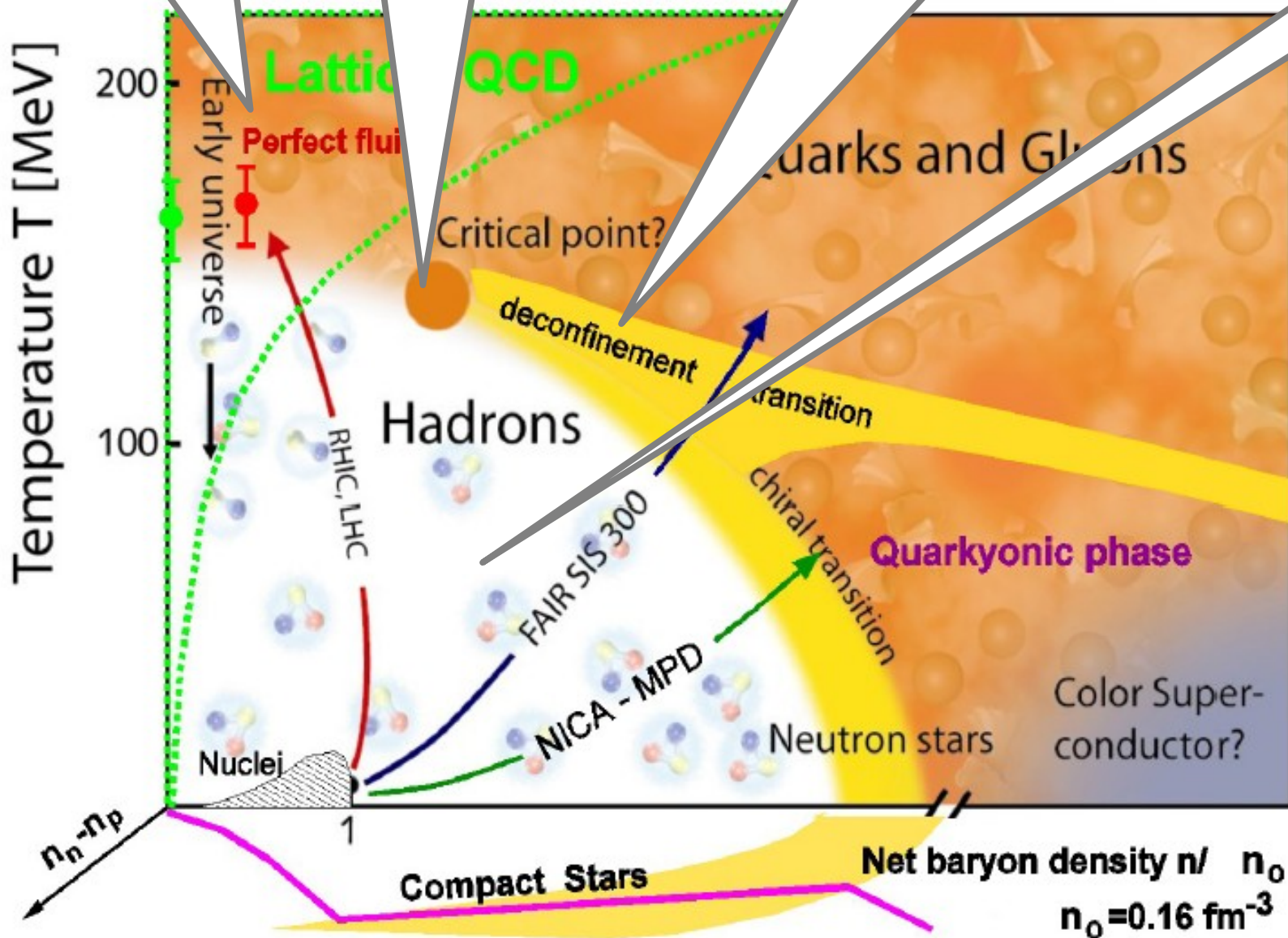
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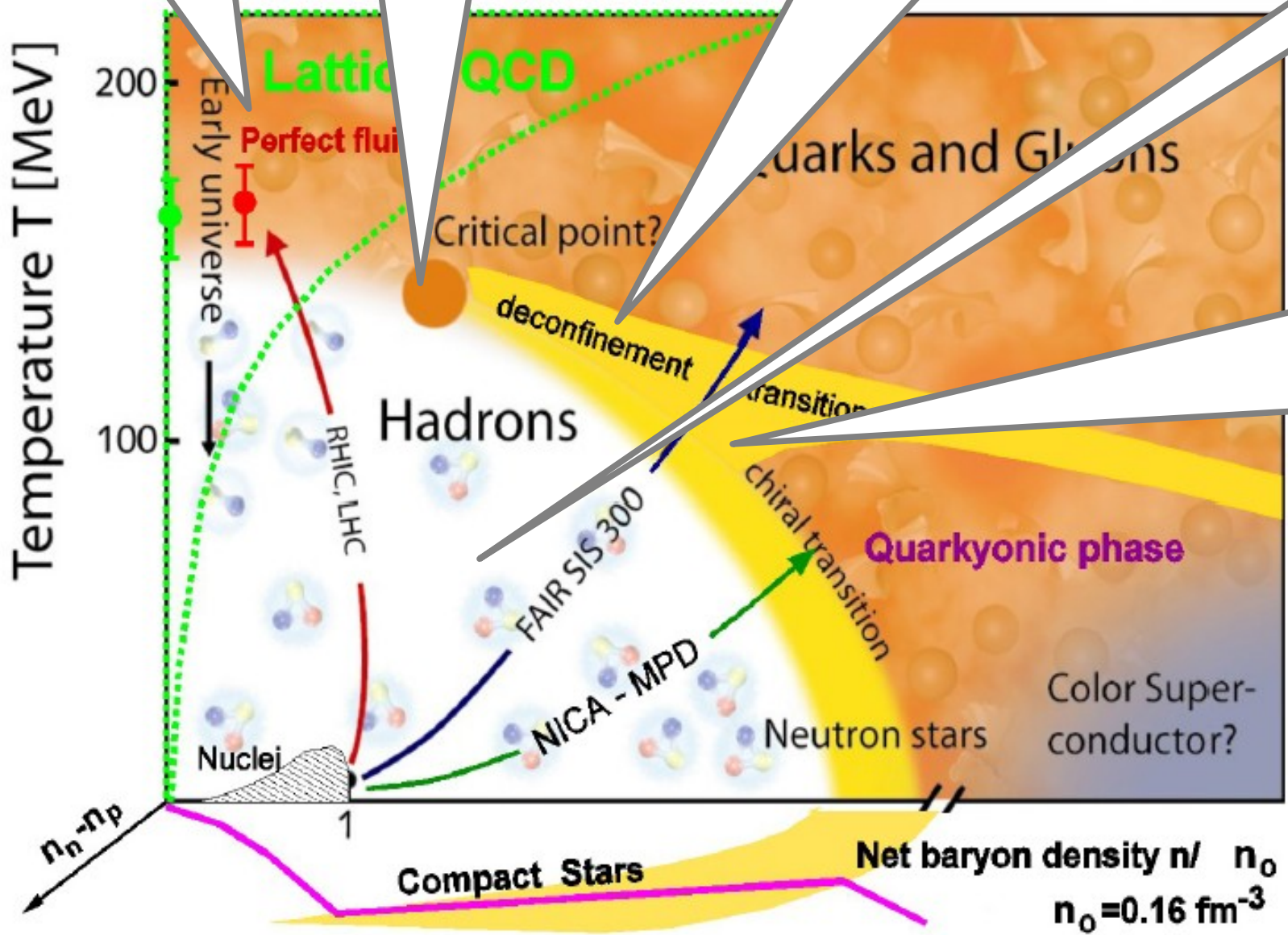
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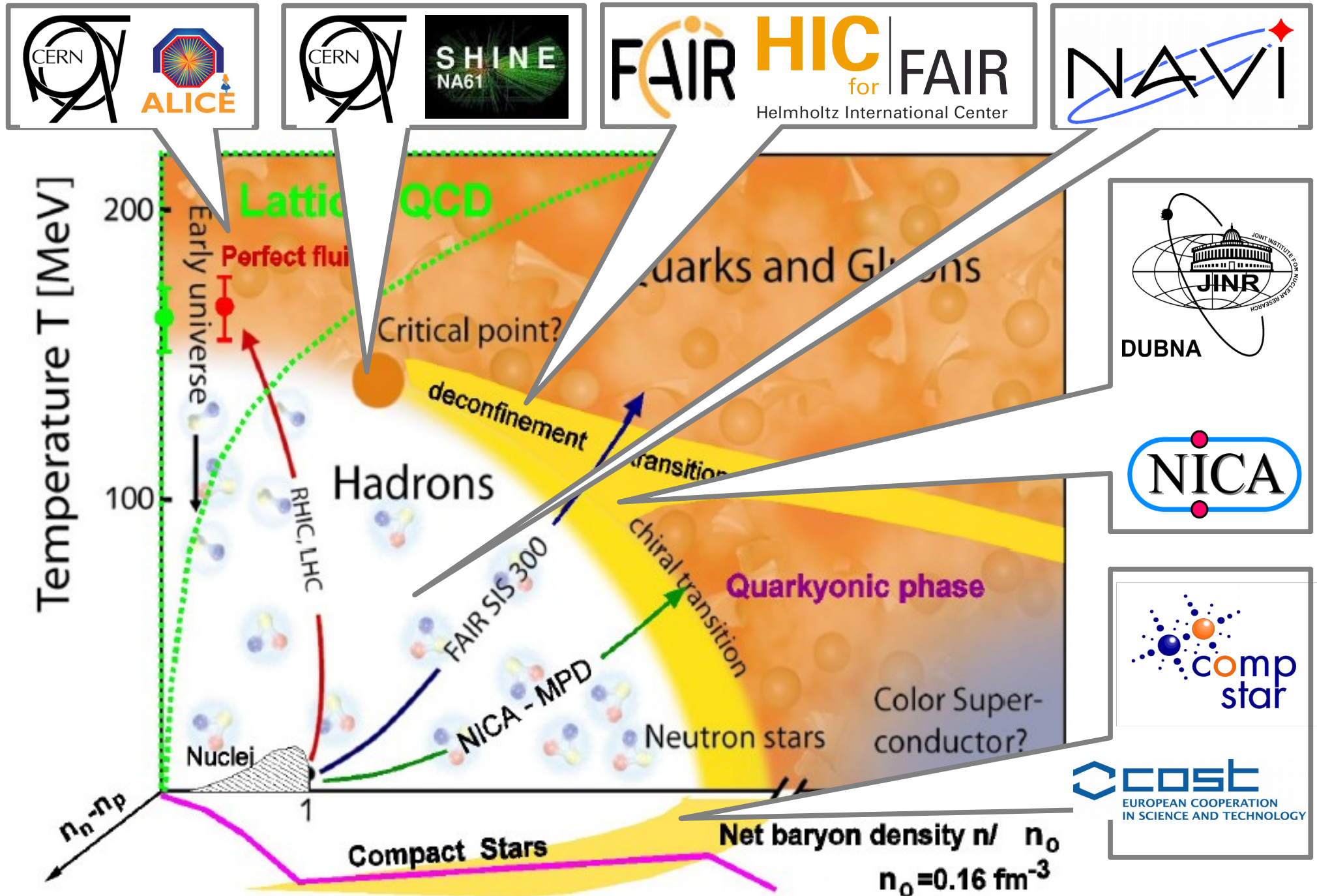
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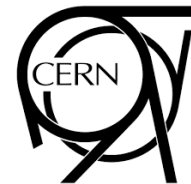


Division: Theory of Elementary Particles - Collaborations



Division: Theory of Elementary Particles

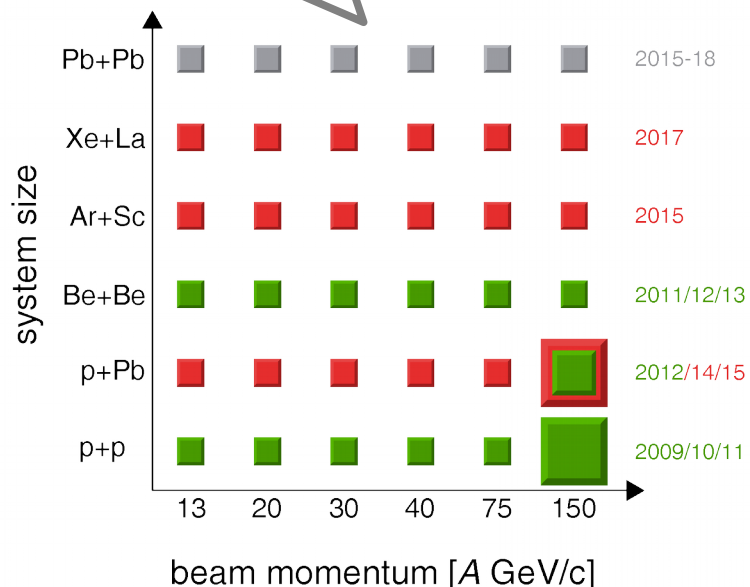
Collaboration with CERN Experiment NA61/SHINE since 2011



Goals of the experiment:

- study of the properties of the onset of deconfinement and the search for the critical point of strongly interacting matter with nucleus-nucleus, proton-proton and proton-lead collisions at six collision momenta
- Precise hadron production measurements for calibrating neutrino beams at J-PARC, Japan and Fermilab, US. Proton/pion-carbon and proton/pion-(replica target) interactions recorded
- Precise hadron production measurements for reliable simulations of cosmic-ray air showers in the Pierre Auger Observatory and KASCADE experiments

Energy and system size scan for Finding the QCD critical endpoint



NA61/SHINE Collaboration



- SPS Heavy Ion and Neutrino Experiment (SHINE)
- Located at the Super Proton Synchrotron (SPS)
- 140 Physicists from 14 countries and 28 institutions

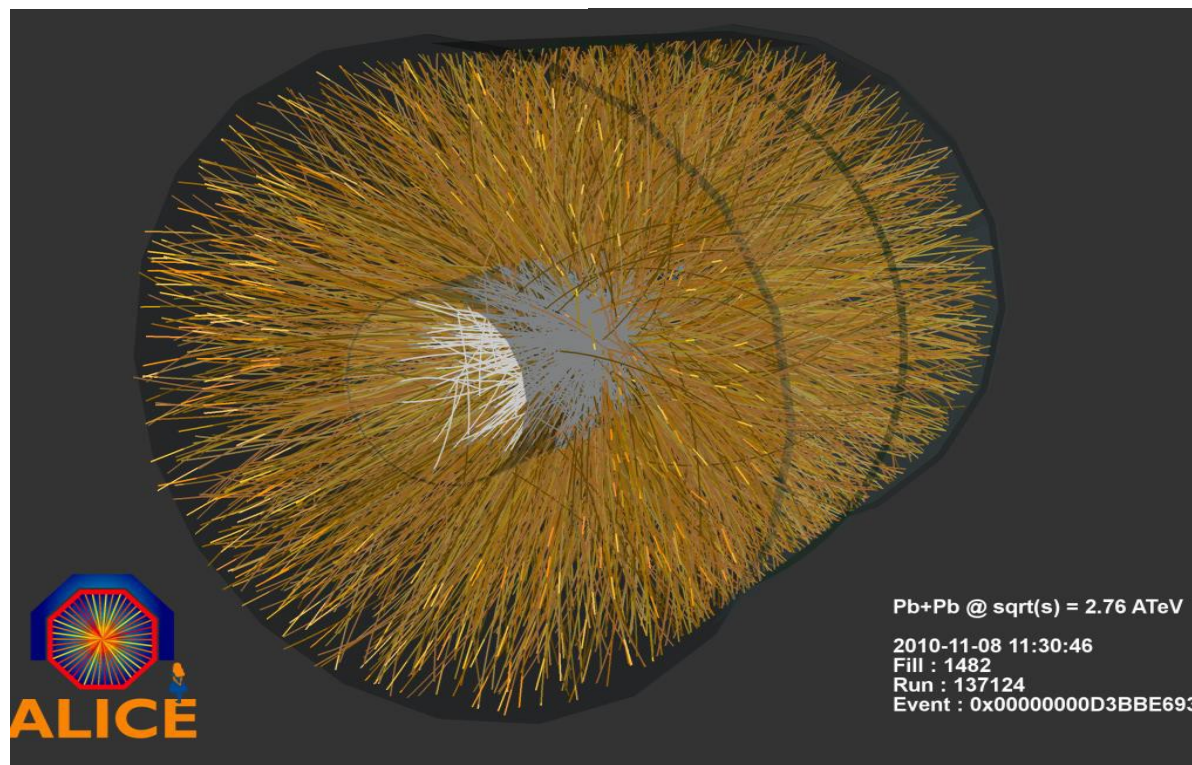
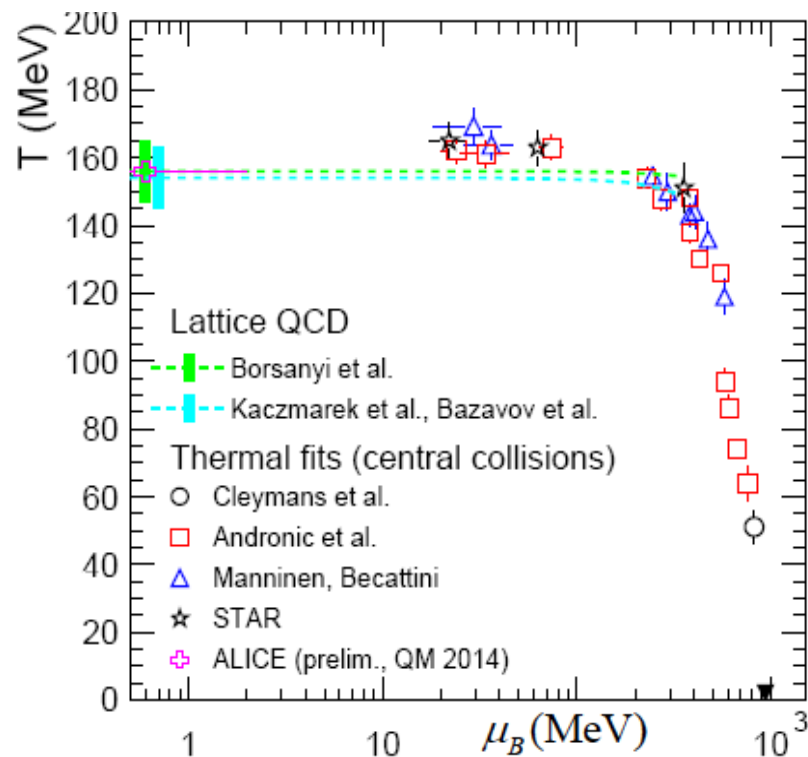
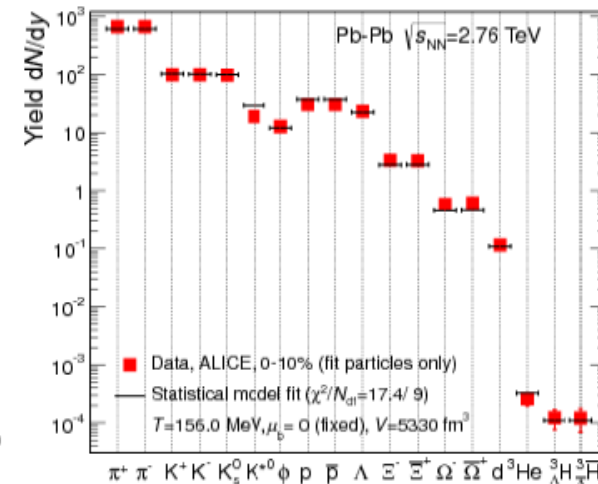
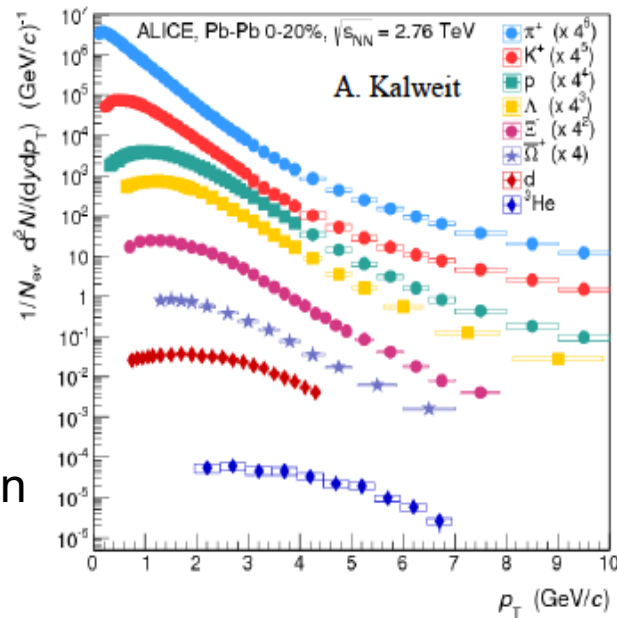
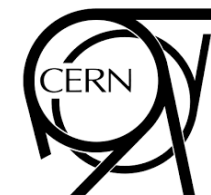


Institute of Radiation Problems, Baku, Azerbaijan
 Faculty of Physics, University of Sofia, Sofia, Bulgaria
 Ruđer Bošković Institute, Zagreb, Croatia
 LPNHE, University of Paris VI and VII, Paris, France
 Karlsruhe Institute of Technology, Karlsruhe, Germany
 Fachhochschule Frankfurt, Frankfurt, Germany
 University of Frankfurt, Frankfurt, Germany
 University of Athens, Athens, Greece
 Wigner Research Centre for Physics of the Hungarian Academy of Sciences, Budapest, Hungary
 Institute for Particle and Nuclear Studies, KEK, Tsukuba, Japan
 University of Bergen, Bergen, Norway
 Institute for Nuclear Research, Moscow, Russia
 Joint Institute for Nuclear Research, Dubna, Russia
 St. Petersburg State University, St. Petersburg, Russia
 University of Belgrade, Belgrade, Serbia
 ETH Zürich, Zürich, Switzerland
 University of Bern, Bern, Switzerland
 University of Geneva, Geneva, Switzerland
 Jan Kochanowski University in Kielce, Poland
 National Center for Nuclear Research, Warsaw, Poland
 Jagiellonian University, Cracow, Poland
 University of Silesia, Katowice, Poland
 Faculty of Physics, University of Warsaw, Warsaw, Poland
 University of Wrocław, Wrocław, Poland
 Warsaw University of Technology, Warsaw, Poland
 University of Colorado Boulder, Colorado, USA
 Los Alamos National Laboratory, New Mexico, USA
 University of Pittsburgh, Pennsylvania, USA

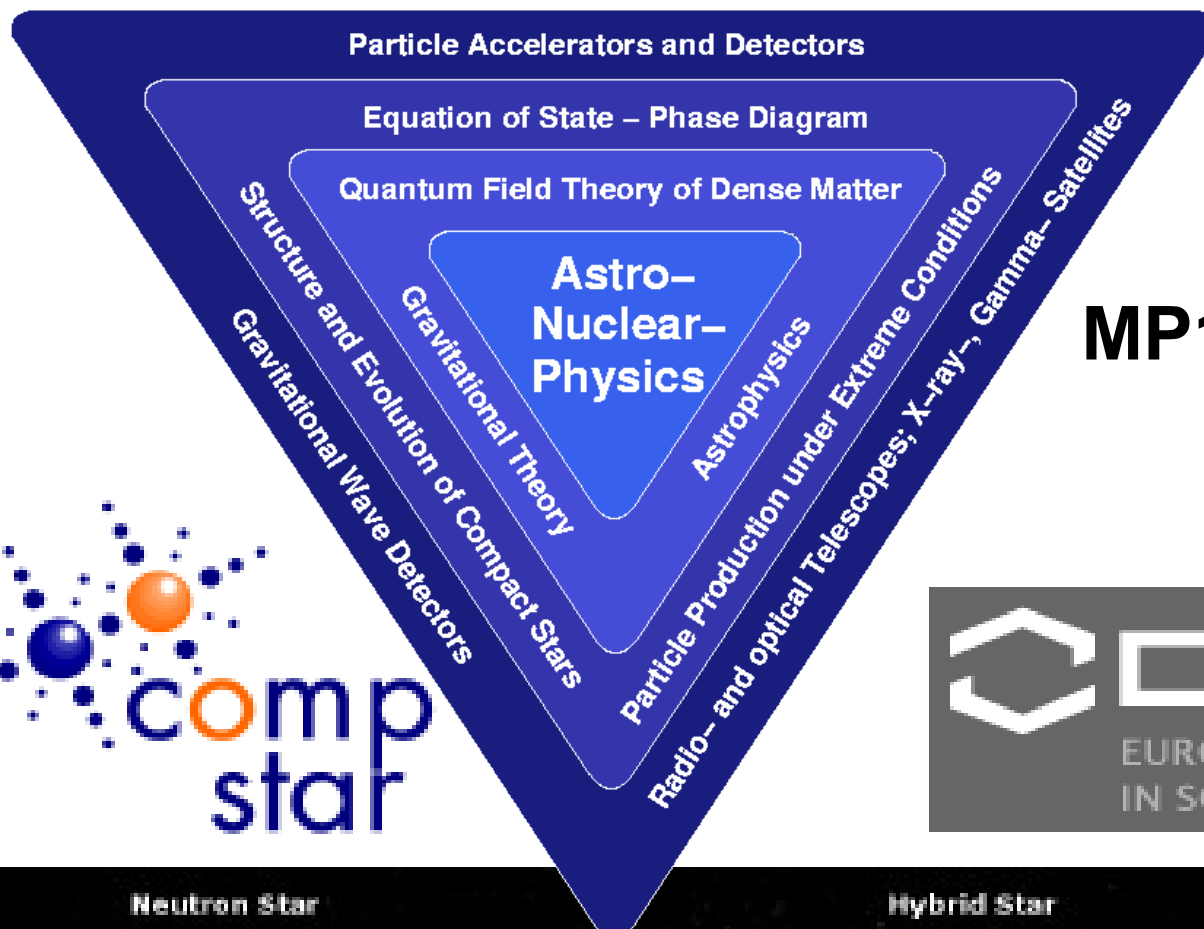
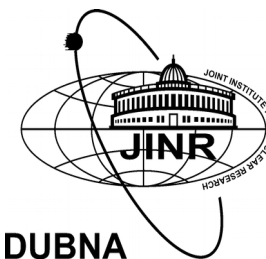
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Collaboration with ALICE @ CERN

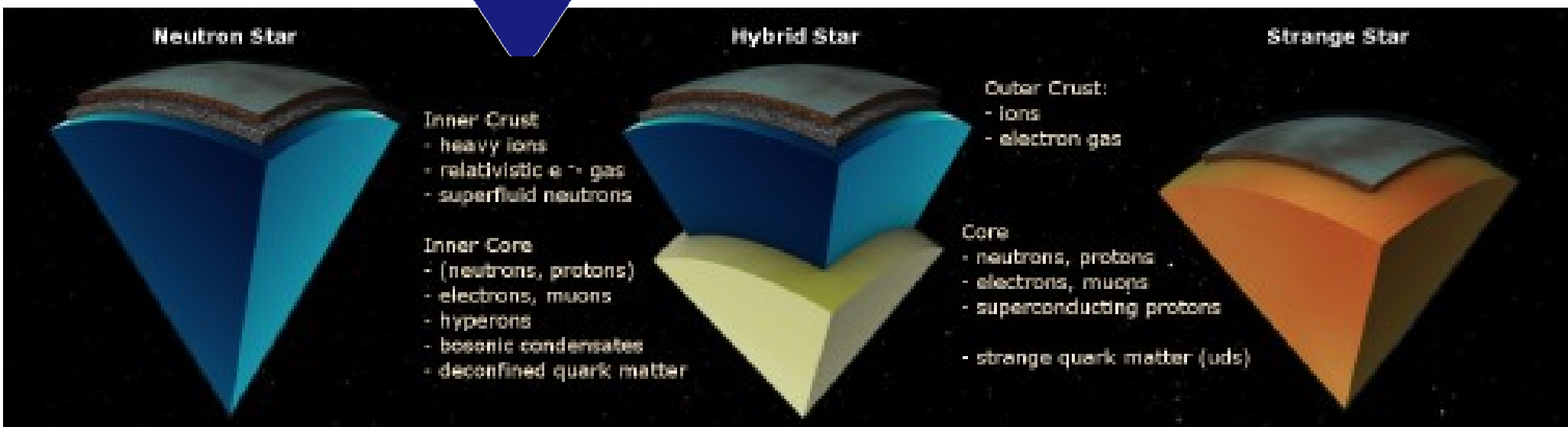
- excellent particle identification
- high statistics data allow new level unprecedented accuracy
- multihadron production near the QCD phase boundary challenges our understanding of the process of nonequilibrium QGP hadronization
- confirmation of lattice QCD theory



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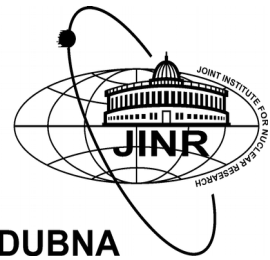


COST Actions:
MP1304 “NewCompStar”,
CA 15213 “THOR”,
CA 16214 “PHAROS”



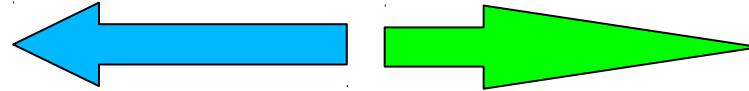
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Collaboration with NICA – MPD Collaboration at JINR Dubna and COST Action MP1304 “NewCompStar”

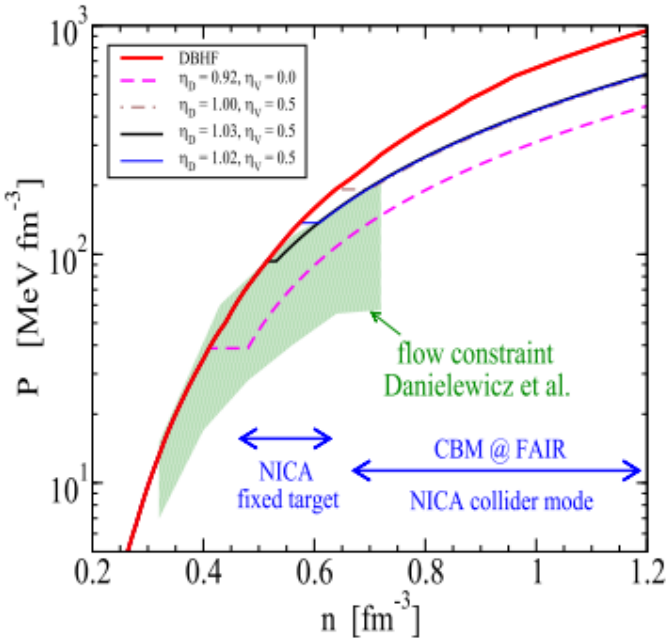


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Heavy-Ion Collisions

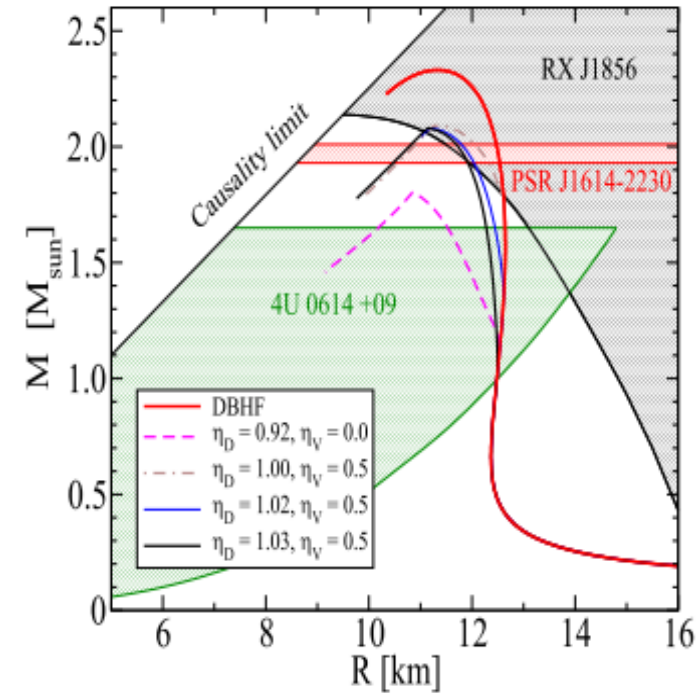


Compact Stars



- stiff EoS (at flow limit)
- low n_{crit} (at NICA fixT)
- soft EoS (dashed line)

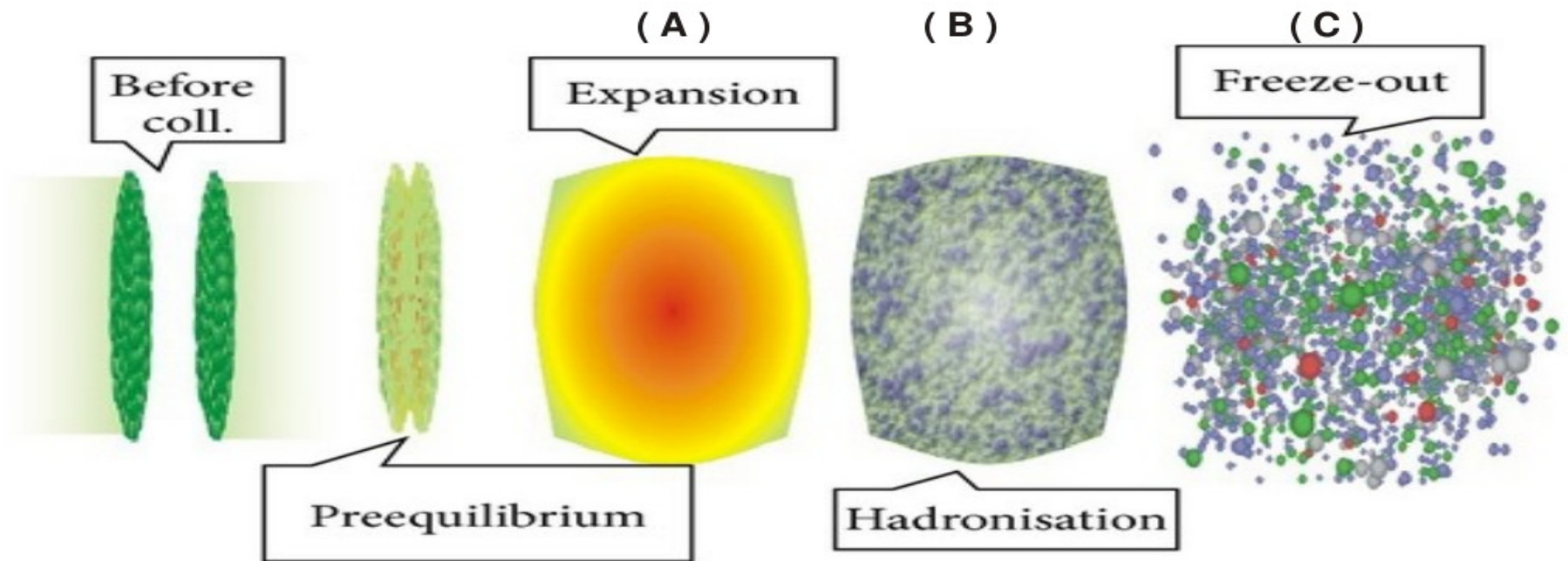
- high M_{max} (J1614-2230)
- low M_{onset} (all NS hybrid)
- excluded (J1614-2230)



**MC PL
members
3 Actions**



Quantum Kinetics of Particle Production in Strong Fields



Generic kinetic equation with scalar (mass) and color meanfields, Schwinger source terms and collision integrals for hadronization and rescattering

$$\left[\partial_t + \frac{1}{E_X} \vec{p} \cdot \vec{\nabla} - \frac{m_X(\vec{x}, t)}{E_X} \vec{\nabla} m_X(\vec{x}, t) \cdot \vec{\nabla}_p + \vec{F}(\vec{x}, t) \cdot \vec{\nabla}_p \right] f_X(\vec{p}, \vec{x}; t) = S_X^{\text{Schwinger}} \{f_q, f_{\bar{q}}, f_\pi, \dots\} + C_X^{\text{gain}} \{f_q, f_{\bar{q}}, f_\pi, \dots\} - C_X^{\text{loss}} \{f_q, f_{\bar{q}}, f_\pi, \dots\}$$

- (A) quark-antiquark pair creation in time-dependent color electric background field
- (B) quantum kinetics of pre-hadron inelastic rescattering in the dense quark plasma
- (C) chemical freeze-out by Mott-Anderson localization of bound states

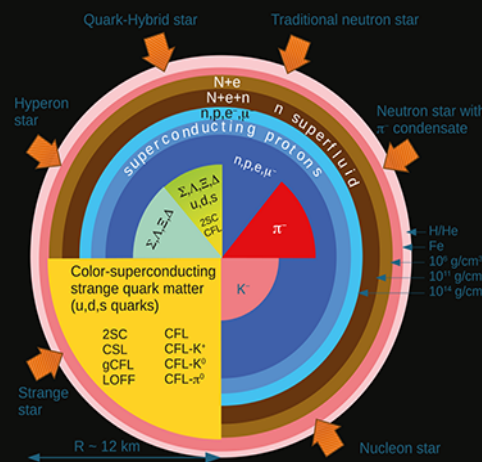
Topical Issue on Exploring Strongly Interacting Matter at High Densities - NICA White Paper
 edited by David Blaschke, Jörg Aichelin, Elena Bratkovskaya, Volker Friese, Marek Gazdzicki, Jørgen Randrup, Oleg Rogachevsky, Oleg Teryaev, Viacheslav Toneev



From: Three stages of the NICA accelerator complex by V. D. Kekelidze et al.

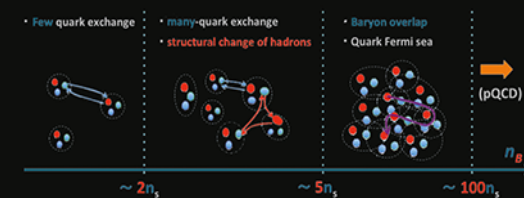


Inside: Topical Issue on Exotic Matter in Neutron Stars
 edited by David Blaschke, Jürgen Schaffner-Bielich and Hans-Josef Schulze



From: Neutron star interiors: Theory and reality by J.R. Stone (left)

Phenomenological neutron star equations of state: 3-window modeling of QCD matter by T. Kojo (right)



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