Recent results on quark plasma at extreme densities in neutron stars and their mergers

David Blaschke[a,b,c], Tobias Fischer[a] & Andreas Bauswein[d]

a – University Wroclaw, b - JINR Dubna, c – NRNU (MEPhI) Moscow, d – GSI Darmstadt

TOPICS:

1. **Theory for Matter under Extreme Conditions:**
   Quark – Nuclear Plasma in the QCD phase diagram
2. **Application I: Neutron Stars & Mergers - multimessenger Astronomy**
3. **Application II: Supernova simulations - explosion mechanism**
4. **Application III: Heavy-Ion Collisions - signals of deconfinement**

Wydzial Fizyki i Astronomii – Open Day 2022, April 23

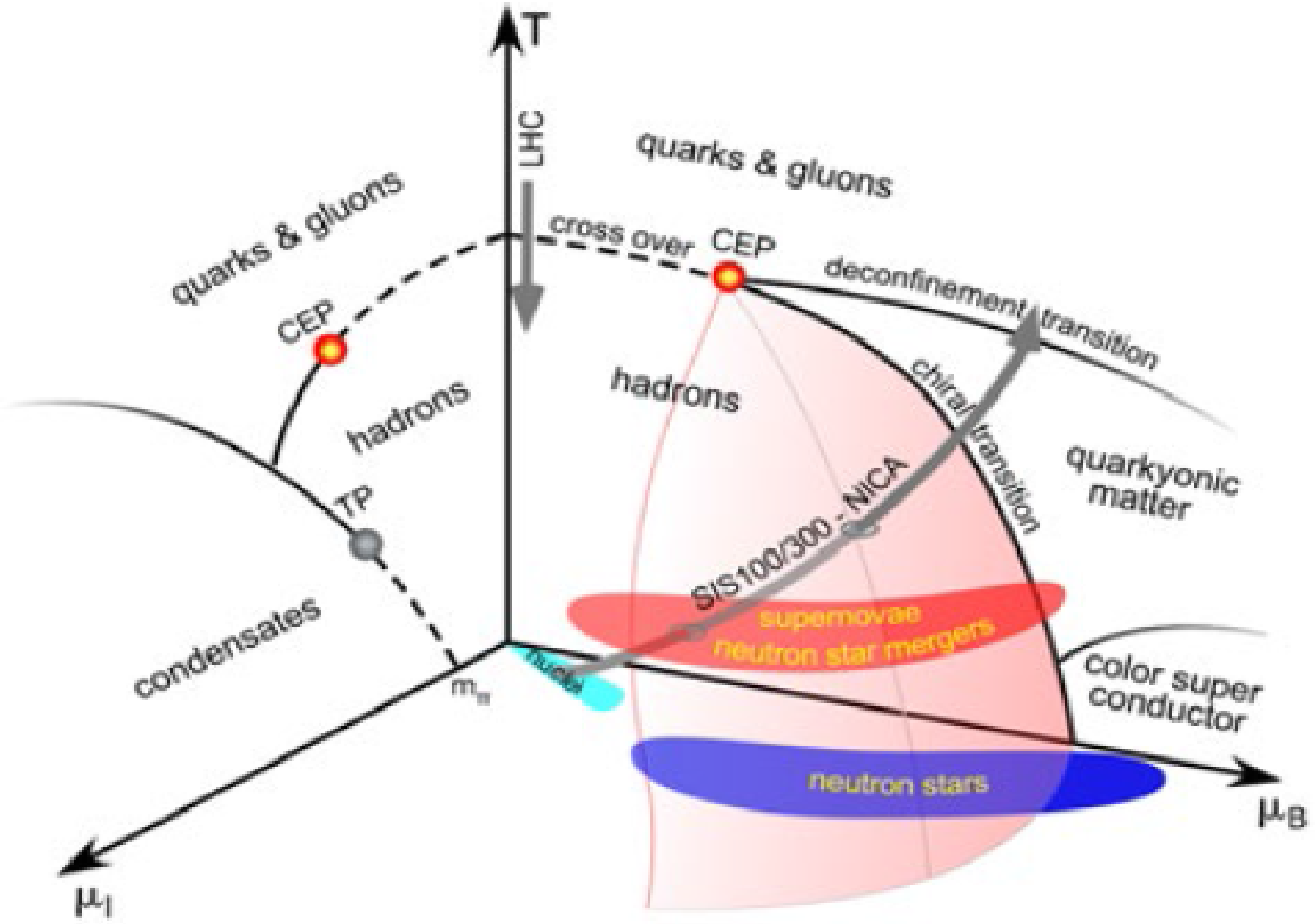
Uniwersytet Wrocławski

NARODOWE CENTRUM NAUKI

PHAROS
THE MULTI-MESSENGER PHYSICS AND ASTROPHYSICS OF NEUTRON STARS

Grant No. UMO 2019 / 33 / B / ST9 / 03059

QCD phase diagram: Heavy Ion Collisions vs. Astrophysics

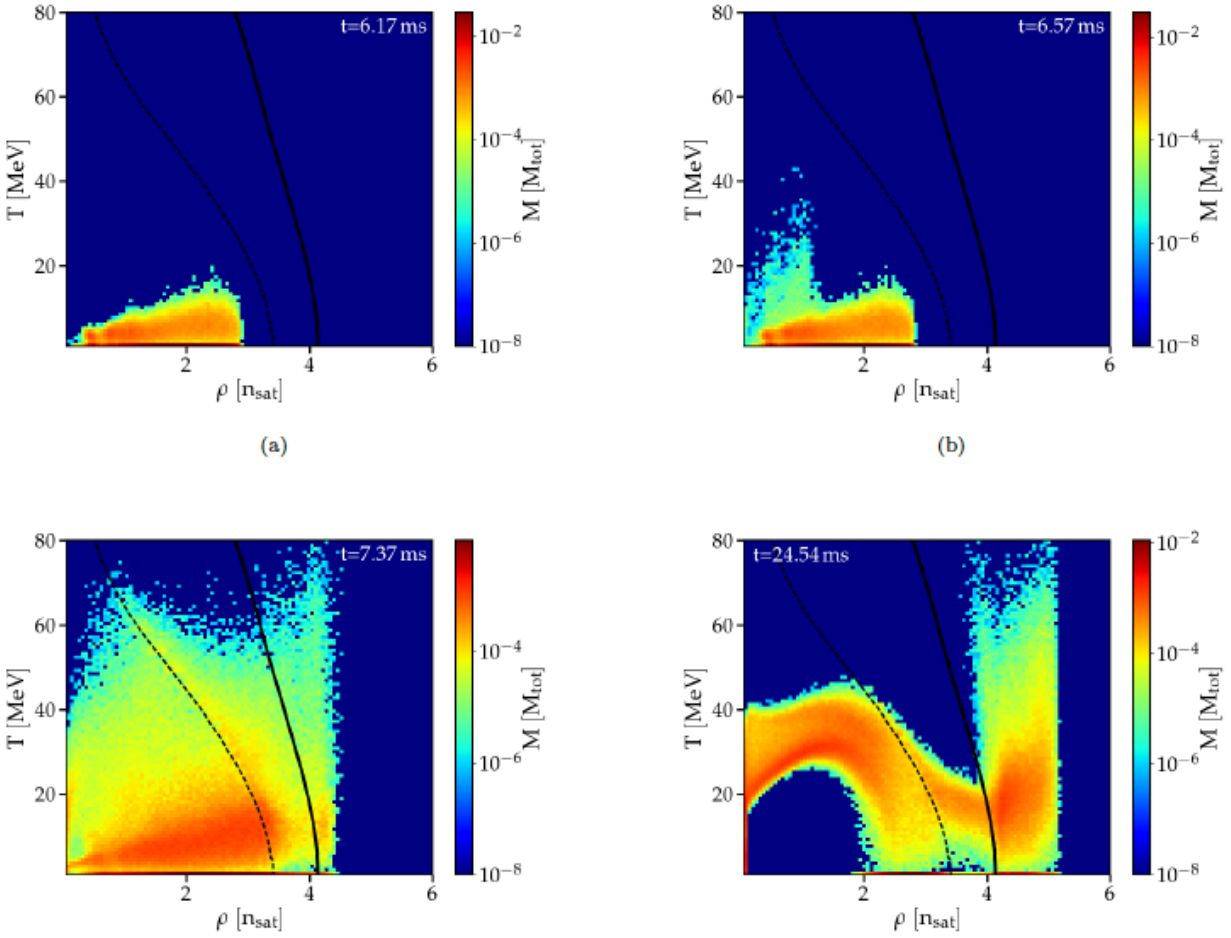


NuPECC Long Range Plan 2017; http://www.nupecc.org

A. Andronic, D. Blaschke, et al., “Hadron production ...”, Nucl. Phys. A 837 (2010) 65 - 86

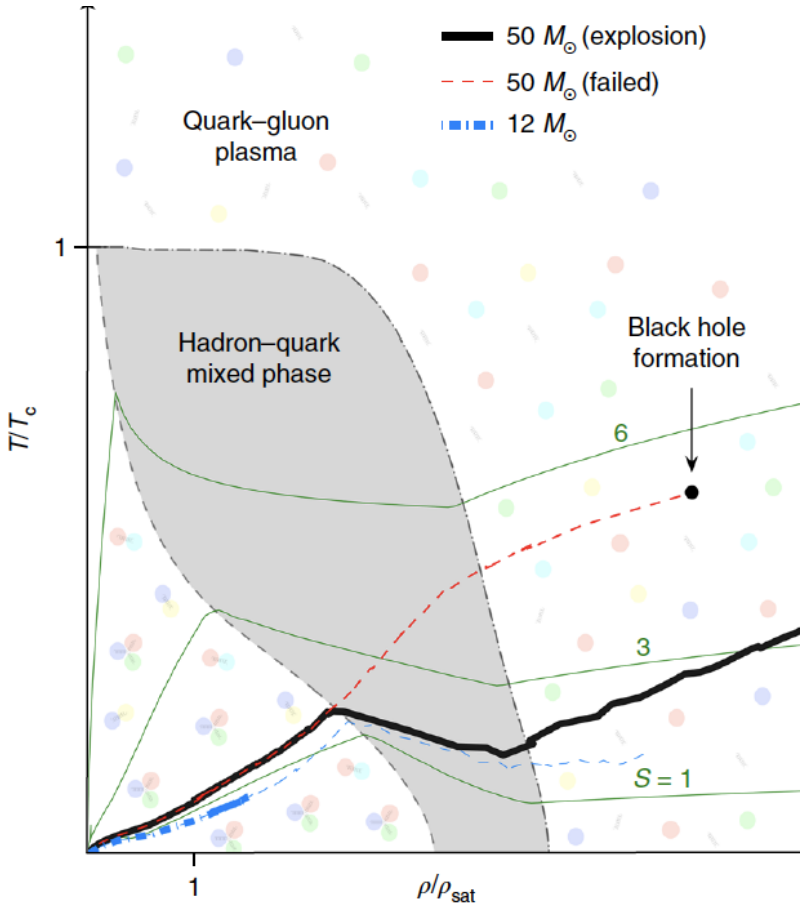
Quark Plasma Trans. in Neutron Star Mergers & Supernovae

Binary NS merger, 1.35 M_sun + 1.35 M_sun



S. Blacker, A. Bauswein et al.,
Phys. Rev. D102 (2020) 123023; arxiv:2006.03789

SN explosion, 50 M_sun



T. Fischer et al.,
Nat. Astron. 2 (2018) 980;
arxiv:1712.08788

Binary neutron star merger simulation

S. Blacker & A. Bauswein (GSI Darmstadt), 1.35 M_sun + 1.35 M_sun

https://www.gsi.de/fileadmin/theorie/simulation-neutron-star-merger.mp4

Population of the QCD phase diagram with mixed phase, 6… 25 ms

S. Blacker, A. Bauswein, N.-U. Bastian, D. Blaschke et al., Phys. Rev. D 102 (2020) 123023