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Influence of neutron skin in heavy ion collisions at RHIC energies

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A key ingredient to model heavy ion collisions dynamically is the initial spatial distribution of protons and neutrons inside the nucleus. Traditionally in most theoretical calculations there is no difference between them and their positions are sampled with the Woods-Saxon distribution. However, this assumption has been invalidated by experimental measurements [1]: The diffusiveness of the neutron distribution is larger than the proton one, resulting in a larger amount of neutrons distributed on the outer layers of the nucleus.
We implement the neutron skin together with nucleon-nucleon correlations, in the initial nuclear distribution of the SMASH transport model [2]. With this new state-of-the-art nuclear parametrization [3] we look at different collision systems (Pb+Pb, Zr+Zr, Ru+Ru) at RHIC energies i.e. $7.7 < \sqrt{s} < 200 GeV$. We compute eccentricity distributions, charge and isospin densities, and the corresponding magnetic fields. As expected, we observe an increased number of neutron-neutron interactions for peripheral collisions leading to a modification of electric charge dependent observables. In addition, we found a ~10% enhancement of the strength of the magnetic field. The implication of this result for the Chiral Magnetic Effect searches with the isobar run at RHIC is discussed.

[1] Phys. Rev. Lett. 112, 242502
[2] Phys. Rev. C 94, 054905
[3] arXiv:1811.10078v1

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