

****Isospin-Driven Splitting of Chemical Potentials in Isobar Collisions from Lattice QCD****

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Strong magnetic fields produced in relativistic heavy-ion collisions can modify conserved-charge fluctuations and their associated chemical potentials. The Ru and Zr isobars share the same mass number, $A = 96$, but have different charge-to-baryon ratios, making Ru+Ru and Zr+Zr collisions a controlled setting for isolating isospin effects. In this talk, we will present first-principles, continuum-estimated $(2 + 1)$ -flavor lattice-QCD results for isospin-driven splittings of conserved-charge chemical potentials near the QCD crossover, at both vanishing and nonzero external magnetic fields along the pseudocritical line $T_{pc}(eB)$. Under strangeness neutrality and the charge-to-baryon constraint $r \equiv n_Q/n_B$, the difference in nuclear isospin composition is mapped onto the splitting ratios $\Delta\mu_Q/\Delta\mu_B$, $\Delta\mu_S/\Delta\mu_B$, and $\Delta\mu_S/\Delta\mu_Q$. At vanishing magnetic field, the lattice results yield $\Delta\mu_Q < 0$ and $\Delta\mu_S > 0$, with the electric-charge sector dominating, and the splitting ratios are similar in magnitude to recent Bayesian extractions from STAR isobar data. At nonzero magnetic fields, the splitting ratios themselves vary only moderately with eB . A clearer field signal emerges from the Ru-Zr difference in the normalized magnetic-field response: in lattice QCD, the relative response of μ_Q/μ_B is substantially stronger in Ru+Ru than in Zr+Zr. We also present hadron resonance gas (HRG) results and experimentally motivated proxy observables with kinematic cuts to facilitate contact with experiment. These results provide first-principles benchmarks for the conserved-charge response to isospin and magnetic fields in isobar collisions.

This talk is based on our recent work: H.-T. Ding, J.-B. Gu, A. Kumar, and J. Ni, arXiv:2606.30164 [hep-lat] (2026).

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