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Nuclear critical point and fluctuations of conserved charges

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The chemical freeze-out parameters in central nucleus-nucleus collisions are extracted consistently from hadron yield data within the quantum van der Waals (QvdW) hadron resonance gas model. The beam energy dependences for skewness and kurtosis of net baryon, net electric, and net strangeness charges are predicted. The QvdW interactions in asymmetric matter, $Q/B \neq 0.5$, between (anti)baryons yield a non-congruent liquid-gas phase transition, together with a nuclear critical point (CP) with critical temperature of $T_c = 19.5$ MeV. The nuclear CP yields the collision energy dependence of the skewness and the kurtosis to both deviate significantly from the ideal hadron resonance gas baseline predictions even far away, in (T, μ_B)-plane, from the CP. These predictions can readily be tested by STAR and NA61/SHINE Collaborations at the RHIC BNL and the SPS CERN, respectively, and by HADES at GSI. The results presented here offer a broad opportunity for the search for signals of phase transition in dense hadronic matter at the future NICA and FAIR high intensity facilities.

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