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Non-congruent phase transitions in strongly interacting matter within the Quantum van der Waals model

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The non-congruent liquid-gas phase transition (LGPT) in asymmetric nuclear matter is studied using the recently developed Quantum van der Waals model in the grand canonical ensemble. Different values of the electric-to-baryon charge ratio, Q/B, are considered. This non-congruent LGPT exhibits several features which are not present in the congruent LGPT of symmetric nuclear matter. These include a continuous phase transformation, a change in the location of the critical point, and the separation of the critical point and the endpoints. The effects which are associated with the non-congruent LGPT become negligible for the following cases: when Q/B approaches its limiting values, 0.5 or 0, or if quantum statistical effects can be neglected. The latter situation is realized when the particle degeneracy attains large values. The skewness and kurtosis of the baryonic and electric charges fluctuations where calculated along the chemical free-out curve of nucleus-nucleus collisions within Quantum van der Waals - Hadron Resonance Gas model. Due to the existence of the non-congruent LGPT, all four quantities demonstrate large deviations from the Ideal Hadron Resonance Gas baseline.

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