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Phase transitions in a rotating hadron resonance gas

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In addition to the magnetic field, a huge amount of vorticity is expected to be produced in non-central heavy-ion collisions at TeV energies. This vorticity or rotation (ω) can affect the evolution of the system and, hence, the phase diagram of the QCD matter, which is one of the important research areas for both the theoretical and experimental high-energy physics community. In this work, we study the effect of rotation on the phase diagram of hadronic matter. We find that rotation plays a role similar to baryochemical potential (μ_B) on the thermodynamic properties of hadron gas. The rotation adds a new kind of chemical potential called rotational chemical potential. Therefore, the phase transition can occur not only in the $T-\mu_B$ plane but also in the $T-\omega$ plane. We use an interacting hadron resonance gas model with van der Waals kind of attractive and repulsive interaction among the hadrons. We observe a liquid-gas phase transition under the effect of rotation, even at zero baryochemical potential. Moreover, we estimate the higher-order rotational susceptibilities and their ratios to study how the system responds to a small angular velocity. These results allow us to reinvestigate the QCD matter properties under the effect of rotation and study the phase diagram in the $T-\mu_B-\omega$ plane.

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