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### **Critical Properties of Quark Matter at Finite Temperature and Density**

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We examine the nature the soft modes of the QCD phase transitions and their phenomenological consequences. In this talk, we mainly focus on the soft mode of the QCD critical point (CP) at finite  $T$  and baryon chemical potential  $\mu$ . The QCD CP belongs to the same universality class  $Z_2$  as that of the liquid-gas phase transition, and, hence a large density fluctuation is expected around the CP. We apply the relativistic fluid dynamics to analyse the dynamical properties of the density fluctuations, and show that its coupling with the thermal fluctuation is significant, which eventually overwhelms the density fluctuations. We show that the density mode is attenuated around the CP because of the divergence of the correlation length  $\xi$ . We speculate that if a suppression or disappearance of Mach cone is observed as the incident energy is lowered, say to 40 GeV/A at RHIC, it could be a signal of the existence of the QCD CP. We also mention the critical phenomena of the chiral transition and the color superconductivity at finite  $T$ .