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## Exploring the melting of heavy-flavor hadrons and diffusion of charm quarks

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Charm quarks, due to their significant mass, serve as an excellent tool for investigating the de-confined medium composed of quarks and gluons. These charm quarks interact with this medium and carry crucial information about it before they undergo hadronization to form heavy flavor hadrons. In this study, we employ the color string percolation model (CSPM) and the van der Waals Hadron Resonance Gas (VDWHRG) model to study the diffusion of charm quarks and the  $D^0$  meson in both the deconfined and hadronic phases, respectively. CSPM, a QCD-inspired model, proposes that the colored strings are stretched between the partons of the colliding nuclei. As a well-established theoretical framework, it has been employed to compute a range of thermodynamic and transport properties of the matter formed in ultra-relativistic hadronic and heavy-ion collisions. Conversely, the VDWHRG model is a modified hadron resonance gas model. It considers both attractive and repulsive interactions among the hadrons. This model is successful in explaining various lattice QCD results up to a temperature of 180 MeV. We estimate the drag coefficient ( $\gamma$ ) and diffusion coefficients in both momentum ( $B_0$ ) and coordinate space ( $D_s$ ) using the formalism of the CSPM model for the deconfined phase and the VDWHRG model for the hadronic phase. Our findings indicate the existence of a minima for the spatial diffusion coefficient near the deconfinement temperature. This minima suggests a phase transition.

Furthermore, we delve into the phenomenon of melting of charmed hadrons. This is achieved by computing the charm susceptibilities using the VDWHRG model. Our findings indicate a smooth transition in the vicinity of the deconfinement region at a vanishing chemical potential, suggesting a crossover transition. The net charm fluctuations can be deduced experimentally by considering the net number fluctuation of the  $D^\pm$  meson. This has not been executed in experiments thus far. Nevertheless, with ALICE Run-3 progressing towards increased luminosity and improved detection capabilities, this study can be conducted experimentally. This study provides pivotal insights into the characteristics of charm quarks and open charm hadrons, thereby broadening the understanding of the interaction of heavy flavors within a thermalized medium.

### session

F. Heavy Flavor and Quarkonia

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