Quark coalescence based on a transport equation

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Hadron spectra measured at intermediate transverse momenta, p_T=2-6GeV, in 200AGeV Au-Au collisions at the Relativistic Heavy-Ion Collider (RHIC) have revealed a surprisingly large baryon-to-meson ratio ~1 and a so-called constituent quark-number scaling (CQNS) of the elliptic flow, $v_2(p_T)$. Both phenomena are rather naturally explained within quark coalescence models (QCMs), where constituent quarks are combined into hadrons at the phase boundary between a Quark-Gluon-Plasma (QGP) and a hadron gas. QCMs are typically formulated in a collinear, instantaneous approximation which conserves 3-momentum but not total energy, limiting their applicability to sufficiently high p_T [1].

In the present work [2], we employ the Boltzmann equation to compute meson formation via resonant quark-antiquark scattering which improves previous QCMs in that energy is conserved and a proper thermal equilibrium limit can be established. This, in turn, allows a more controlled extension of the approach to low p_T and to address the experimentally observed transition from a hydrodynamic regime to CQNS, while 2→1 scattering restricts the applicability to positive values of $Q=m_M-2m_q$ ($m_{M\,q}$: meson, quark mass). We here focus on the φ meson using input strange-quark distributions with collective properties characteristic for RHIC energies. Our results for φ spectra are summarized in Fig. 1, illustrating that we recover CQNS of v_2 at sufficiently high p_T, but with appreciable sensitivity to the Q value of the

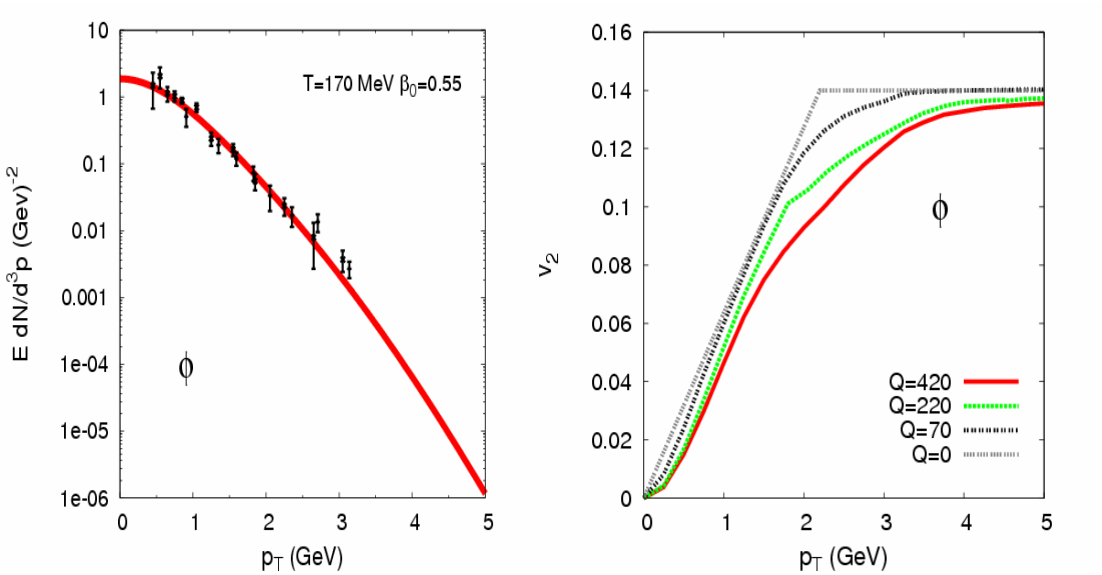

Figure 1. ϕ meson p_T-spectra (left panel, with RHIC data for central 200AGeV Au-Au[3]) and elliptic flow (right panel) as evaluated from resonance formation via the Boltzmann equation in the quasi-stationary case. The right panel illustrates the sensitivity of v_2 to the Q-value of the $s\bar{s}$ fusion process. For Q→0, the input quark-v_2 is recovered.

meson fusion reaction. When extending the approach to include charm quarks, our results are indicative for a general CQNS for v_2 in transverse kinetic energy, as recently found experimentally [4].

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[3] PHENIX Collaboration [S.S. Adler *et al*.], Phys. Rev. C **72**, 014903 (2005); STAR Collaboration, [J. Adams *et al*.], Phys. Lett. B **612**, 181 (2005).

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