Strangeness neutral hadron gas

Assume chemical equilibrium state

⟶ strangeness partition function

$$\ln Z_s^{HG} = \frac{V_h T^3}{2\pi^2}\Big[(\lambda_s \lambda_q^{-1} + \lambda_s^{-1} \lambda_q) \gamma_s F_K + (\lambda_s \lambda_q^{2} + \lambda_s^{-1} \lambda_q^{-2}) \gamma_s F_Y + (\lambda_s^{2} \lambda_q + \lambda_s^{-2} \lambda_q^{-1}) \gamma_s^2 F_\Xi + (\lambda_s^{3} + \lambda_s^{-3}) \gamma_s^3 F_\Omega \Big]$$

$\lambda_a = exp(\mu_a / T)$ $\quad \gamma_s$: *saturation factor*

$F_K = \sum_j g_{Kj} (m_{Kj}/T)^2 K_2(m_{Kj}/T)$, $\quad Kj = K, K^*, \ldots m \le 1780$ MeV

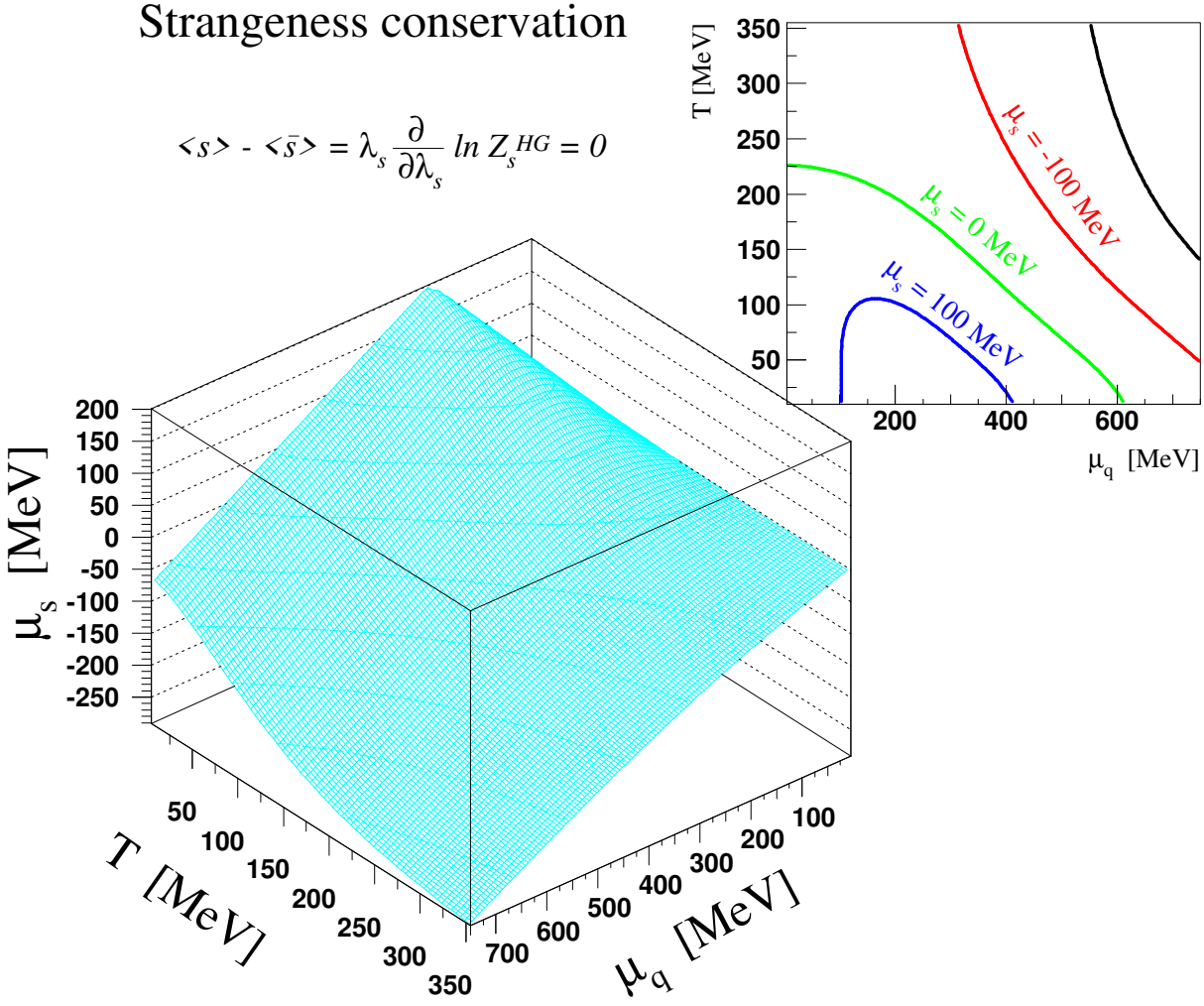
$Yj = \Lambda, \Sigma, \ldots \quad m \le 1940$ MeV

$\Xi j = \Xi, \Xi(1530), \ldots \quad m \le 1950$ MeV

$\Omega j = \Omega, \Omega(2250)$

g : spin-isospin degeneracy factor

(This formation is referred from Phys. Rev. D51 3408 (1995) J Letessier et al)

Strangeness conservation

$$\langle s \rangle - \langle \bar{s} \rangle = \lambda_s \frac{\partial}{\partial \lambda_s} \ln Z_s^{HG} = 0$$