where $\pi_0 = const. \ln(1-u)\theta(1-2u) + \theta(2u-1)$, with $u = \Delta F\, L$, modifies the small-L behaviour for which the exponential form is not appropriate. Here ΔF is the change in the free energy of the system that is associated with the conversion from partons to clusters. In our case (for baryon-free matter in general),

$$\Delta F \;=\; E_{vol} \;+\; E_{surf} \;=\; \frac{4\pi}{3}\, R^3(L)\, \Delta P(L) \;+\; 4\pi\, R^2(L)\, \sigma(L)\;, \tag{59}$$

where $R(L)$ is the radius of the bubble depending on the parton separation. The first term is the volume energy determined by the difference of pressure in the perturbative and the non-perturbative vacuum,

$$\Delta P(L) \;= P_{qg}(L) \;-\; P_\chi(L)\;. \tag{60}$$

The second term in (59) is the surface energy with the surface tension estimated to be

$$\sigma(L) \;=\; \int_0^{\chi_c} d\chi\, \sqrt{2\,\mathcal{V}(L)} \;\approx\; 2\, \int_{\chi_{max}}^{\chi_c} d\chi\, \sqrt{2\,\mathcal{V}(L)} \tag{61}$$

where χ_c corresponds to the local minimum of $\mathcal{V}$ at L_c and χ_{max} is the point of the local maximum of $\mathcal{V}$ that separates unconfined and confined domains, as defined in Fig. 2.

A parton bubble is stable if $\partial \Delta F/\partial R = 0$, which leads to the condition for the stationary bubble radius,

$$R_c \;\equiv\; R(L_c) \;=\; \left.\frac{2\,\sigma}{\Delta P}\right|_{L=L_c} \tag{62}$$

When inserted in (59), this gives for (58)

$$\pi(L) \;=\; \pi_0(L)\, \left(1 \;-\; \exp\left[-\frac{4\pi}{3}\, R_c^2 \sigma_c\, L\right]\right) \tag{63}$$

with $\sigma_c \equiv \sigma(L_c)$. In accord with our definition (3), we interpret the space-time scale L as the characteristic inter-parton separation, that is, we define it in terms of the distance measure Δ_{ij} between two partons, labeled with indices a and b,

$$\Delta_{ab} \;=\; \sqrt{r_{ab}^\mu\, r_{ab,\mu}}\;, \qquad r_{ab} \;=\; r_a \;-\; r_b\;, \tag{64}$$

and identify L with the the minimum distance L_{ab} for a certain parton a to its next neighbour b:

$$L(r) \;=\; L_{ab} \;\equiv\; \min{}_b(\Delta_{a1}, \ldots, \Delta_{ab}, \ldots, \Delta_{an})\;. \tag{65}$$

Other measures are possible, e.g. $\Delta_{ab} = (1/x_{ab}^2 + 1/y_{ab}^2 + 1/z_{ab}^2 + 1/(\Delta t)^2)^{-1/2}$, but we find that the particular choice of Δ_{ab} is not crucial as long it provides a reasonable distance