species α individually. For instance, in the absence of viscosity:

$$\begin{aligned}
n_\alpha(r) &= n_{\mu\,\alpha}(r)\, u^\mu_\alpha(r) \\
P_\alpha(r) &= -\frac{1}{3}\, T_{\mu\nu,\,\alpha}(r) \left(g^{\mu\nu} - \; u^\mu_\alpha(r) u^\nu_\alpha(r) \right) \\
\varepsilon_\alpha(r) &= T_{\mu\nu,\,\alpha}(r)\, u^\mu_\alpha(r) u^\nu_\alpha(r) \quad .
\end{aligned} \tag{41}$$

Due to the scalar character of these quantities, they provide local, Lorentz-invariant measures of the many-particle system. It is left to convenience in which Lorentz frame the calculation is performed, but in general it is considerably simplified in the local rest frame of the matter where $u^\mu = (1, \vec{0})$. The total number and the free energy of the particles at a given time can then be obtained by integrating over position space.

4. PARTON-HADRON CONVERSION OF FRAGMENTING JET SYSTEMS

The preceding kinetic formulation allows us now to apply the conceptual ideas of the effective field theory of Sec. 2 to the dynamics of parton-hadron conversion in rather general situations. In accord with the formalism of Sec. 2, the parton-hadron transition can be visualized as the conversion of high-momentum colored quanta of the fundamental quark and gluon fields into color-neutral composite states that correspond to local excitations of the condensate fields χ and U embedded in the physical vacuum.

Ultimately, we would like to address the dynamics of the (non-equilibrium) QCD phase transition in finite-temperature systems. Here, however, we will as a first application study a much simpler sytem, namely the fragmentation of a $q\bar{q}$ jet system with its emitted bremsstrahlung gluons, and describe the evolution of the system as it converts from the parton phase to the hadronic phase (illustrated in Fig. 5). A time-like virtual photon in an e^+e^- annihilation event with large invariant mass $Q \gg \Lambda_{QCD}$ ($\Lambda_{QCD} = 200 - 400$ MeV), corresponding to a very small initial size $L \ll L_c$ ($L_c = 0.5 - 1\; fm$), is assumed to produce a $q\bar{q}$ pair which initiates a cascade of sequential gluon emissions. The early stage is characterized by emission of “hot” gluons far off mass shell in the perturbative vacuum. Subsequent gluon branchings yield “cooler” gluons with successively smaller virtualities, until their mutual separation approaches $L \approx L_\chi$. As is evident from the previous Fig. 2, this point characterizes the beginning of the transition, because the partons can now tunnel through the developing potential barrier and form color-singlet composite states, which