$$
\begin{aligned}
i\,\Delta(x,y) \;&:=\; \langle\, T\,\chi(x)\,\chi(y)\,\rangle \;-\; \langle\, \chi(x)\,\rangle\,\langle\, \chi(y)\,\rangle\;, \\
i\,\tilde{\Delta}(x,y) \;&:=\; \langle\, T\,U(x)\,U^{\dagger}(y)\,\rangle \;-\; \langle\, U(x)\,\rangle\,\langle\, U^{\dagger}(y)\,\rangle\;,
\end{aligned}
\tag{27}
$$

where $\langle\ldots\rangle$ denotes the vacuum expectation value, or, in a medium, the appropriate ensemble average, and $T\,A(x)B(y) = \theta(x_0,y_0)A(x)B(y) \pm \theta(y_0,x_0)B(y)A(x)$ stands for the generalized time-ordering operator along a closed time contour [21] with $+(-)$ for boson (fermion) operators. For the χ and U fields, we have subtracted the classical expectation values in order to separate the quantum fluctuations of the fields around the classical field configuration. These Green functions generally describe the propagation of an excitation in a many-particle system from space-time point x to point y. In the absence of a coupling between ψ, A^{μ} and χ, U, and in the zero-density limit, the expectation values S_{ij} and $D^{\mu\nu}_{ab}$ can be shown [19] to reduce to the usual quark and gluon Feynman propagators, respectively, and Δ with the scalar Feynman propagator.

Using the definitions (27) and implementing the gauge-fixing constraint in (25) for the gluon fields, one finds from (25) the following equations of motion for the Green functions (in the limit of zero rest masses),

$$
\begin{aligned}
i\gamma\cdot\partial_x\; S_{ij}(x,y) \;&=\; \delta_{ij}\delta^4(x,y) \;+\; \int d^4x'\,\Sigma_{ik}(x,x')\,S_{kj}(x',y) \\
\partial_x^2\; D^{\mu\nu}_{ab}(x,y) \;&=\; \delta_{ab}\delta^4(x,y)\,\Big(\, g^{\mu\nu} \;-\; \mathcal{E}^{\mu\nu}\Big) \;-\; \int d^4x'\,\Pi^{\mu}_{\sigma,\;a,b'}(x,x')\,D^{\sigma\nu}_{b'b}(x',y) \\
\partial_x^2\;\Delta(x,y) \;&=\; -\delta^4(x,y) \;+\; \int d^4x'\,\Xi(x,x')\,\Delta(x',y) \\
\partial_x^2\;\tilde{\Delta}(x,y) \;&=\; -\delta^4(x,y) \;+\; \int d^4x'\,\tilde{\Xi}(x,x')\,\tilde{\Delta}(x',y)\;,
\end{aligned}
\tag{28}
$$

describing the change with respect to x, plus similar equations for the change with y by the substitions $\partial_x \to -\partial_y$, and $\Sigma(x,x')S(x',y) \to S(x,x')\Sigma(x',y)$, etc.. The explicit expressions for the *self energies* Σ, Π, Ξ, and $\tilde{\Xi}$ are rather lengthy and can be found in Ref. [19]. We remark that the functions Σ and Π include both the usual quark and gluon self energies, as well as the additional interaction of the quanta with the χ field. Similarly, the self energy Ξ incorporates the effective self interaction of the χ field described by the potential (11), plus the interaction with the quark and gluon fields in (22). Finally, the self energy of the U field plus its coupling to the χ field is described by $\tilde{\Xi}$. In the equation for the gluon Green