Many Body Physics 220
Fall 2009

The notation used in class is a variant of that in
J. M. Luttinger and J. C. Ward, Phys Rev 118, 1417 (1960)

This (LW) is a classic paper on finite temperature many body physics. We will follow the structure and rules given here after changing from their somewhat archaic notation to the modern one. The notation that is used almost universally these days is that in the book by Abrikosov Gorkov and Dzyaloshinsky. I indicate the changes below, and indicate the equation numbers in the paper

$$
\begin{aligned}
\zeta_l &= i(2l+1)\pi k_B T + \mu \rightarrow i\omega_l + \mu \text{ Eqn 27} \\
g_r(u-u') &\rightarrow G_0(r, u-u') \text{ Eqn 24 time domain Greens function} \\
\frac{1}{\zeta_r - \varepsilon_r} &\rightarrow G_0(r) \text{ Rule 3 page 1420} \\
S_r(\zeta_l) &\rightarrow G_0(r) \text{ Rule 3 page 1420} \\
S'_r(\zeta_l) &\rightarrow G(r) \text{ Eq 39. Renormalized (full) Greens function} \qquad (1) \\
G_r(\zeta_l) &\rightarrow \Sigma(r) \quad \text{Eq 39 Irreducible self energy} \\
G'_r(\zeta_l) &\rightarrow \Sigma_{\text{reducible}}(r) \quad \text{Eq 41 reducible self energy.} \qquad (2)
\end{aligned}
$$

We will also follow a four vector notation as far as possible. Thus it is convenient to denote $k = \{\vec{k}, i\omega_l\}$.