

In BCS theory, this interaction leads to the ‘gap equation’ for the pairing gap  $\Delta_{\mathbf{k}} \propto \langle c_{\mathbf{k}\uparrow} c_{-\mathbf{k}\downarrow} \rangle$ .

$$\Delta_{\mathbf{k}} = - \sum_{\mathbf{p}} \left( \frac{3\chi_0}{\xi^{-2} + (\mathbf{p} - \mathbf{k} - \mathbf{K})^2} \right) \frac{\Delta_{\mathbf{p}}}{2\sqrt{\varepsilon_{\mathbf{p}}^2 + \Delta_{\mathbf{p}}^2}}$$

Non-zero solutions of this equation require that  $\Delta_{\mathbf{k}}$  and  $\Delta_{\mathbf{p}}$  have opposite signs when  $\mathbf{p} - \mathbf{k} \approx \mathbf{K}$ .