Exercise-sheet 7 (June 27, 2017)

1 Homework - due Date: July 4, 2017 (20 + 10 points).

1.1 Numerical determination of the gap function (15)

Numerically solve the gap equation

$$1 = gN(0) \int_0^{\hbar\omega_D} \frac{d\xi}{(\xi^2 + \Delta^2)^{\frac{1}{2}}} \tanh \frac{(\xi^2 + \Delta^2)^{\frac{1}{2}}}{2k_B T}, \tag{1}$$

and plot your results for $\Delta(T)/k_B T_c$ against T/T_c.

Hand in your (python, c++, mathematica) script and the corresponding plot as an email.

1.2 Revisiting representation theory (5 + 10 Bonus)

Before starting studying more complex types of superconducting order parameters (i.e. beyond $s-$wave scattering), let us revisit some basic concepts of representation theory which will prove very useful in the evaluation of the free energy for $p-$ and $d-$wave superconductors.

Consider the symmetry group of a regular tetrahedron.

(a) Decompose it into classes.

(b) Construct its character table.