PHYSICS 239 : SUPERCONDUCTIVITY
HW ASSIGNMENT #4

(1) Calculate the zero temperature tunneling density of states $N(\omega)$ in d-wave nodal superconductors. You need to go through the steps to express $N(\omega)$ in term of elliptic integrals (complete, first kind). Please derive the asymptotic behavior for $\hbar\omega/\Delta \rightarrow 0$, 1, and ∞, respectively. Compare your results with those of the s-wave superconductors. (See pages 11-12 in the lecture notes, chapter 5.)

(2) Calculate the low temperature paramagnetic magnetic susceptibility (NMR Knight shift) of d-wave nodal superconductors at $k_{\rm B}T \ll \Delta$. The numeric coefficient is unimportant, but the power of the temperature dependence is important. You can compare your result with that of the s-wave case. You also need to learn the Yoshida function, which is a very useful function for thermodynamics of superconductors. Can you anticipate your results directly from the density of states of nodal quasi-particles? (See pages 16-17 in the lecture notes, chapter 5.)

(2) Explain the physical meaning of the d-vector, $d(\boldsymbol{k})$? How does one use the d-vector to describe the triplet Cooper pairing?