S.p.15. BALAKRISHNA WARRIER, K.–Thesis submitted in partial fulfilment of the requirements for the Degree of Doctor of Philosophy–1982–Dr. C. Purushothaman

The thesis deals with studies on several prperties of anisotropic super-conductors containing pararnagnetic impurities in Shiba-Rusinov model.

I have investigated the effect of gap anisotropy on the Josephson current for an impure superconductor described by SR model. It is observed that as the impurity concentration is increased, the Josephson current gradually decreased and finally goes to zero for a particular value of the impurity concentration. For a given impurity concentration if we increase the Josephson current also increased. The values of the normalized Josephson current for various values of impurity concentration and for two values of the local states within the gap & are given in Table 1. Figure 1 shows the nature of variation of the normalized Josephson current with T/T_c for = 0.95. We noticed that when C = 0.2, the effect of anisotropy is to decrease Josephson current. As we increase the impurity concentation the Josephson current will be increased due to anisotropy.

When $T_K/T_{co} > 1$ as we increase (T/T_{co}) we found that the percentage change in the slope of Josephson current versus $(T/T_{co}$, K^* gradually decreases where as when (T_K/T_{co}) is less than one, the above quantity increases as we increase (T/T_{co}).

The slope of Josephson current versus (T_c/T_{co}), K^* is tabulated for various values of T_K/T_{co}. For (T_K/T_{co}) 1, as more and more impurities are added, the effect of anisotropy is to increase the percentage change in K^* due to anisotropy. For $(T_K/T_{co}$ 1, increase of impurity will decrease the percentage change in K^* due to anisotropy.

When $<a^2> = 0.01$, $K^* = 0.16$ giving a 24.03% deviation from previous calculations. $K^*_{AG} = 0.129$ (for = 1 and $<a^2> = 0$). As the strength of interaction increases (<1) the effect of anisotrophy on $\triangle(C,T)$, $H_C(C,T,)$ and $J_s(C,T,)$ is small, but if the strength of interaction decreases (-1) the effect of anisotrophy is more prominent. For a given value of , for small impurity concentration, the effect of anisotrophy is to increase $\triangle(C,T)$, $H\times(C,T,)$ and $J_s(C,T,)$ but for large impurity concentrations the effecct of anisotropy is to reduce teh above quantities.

I have calculated the anisotropic density of electronic states, $(N(w)/N(O)$. Outside BCS energy gap $(w/\triangle>1)$ density of states will be decreased due to anisotropy and inside BCS energy gap $(w/\triangle< 1)$ it is increased for anisotropic superconductors.

For given impurity concentration as we increase the strength of interaction (decrease) we observe that the percentage change in the normalized zlope of ultransonic attenuation coefficient (C^*/C^*_{AG}) will be more.

The normalized upper critical field $h_{c2}(T)$ increases due to anisotropy as we increase the impurity concentration. For a given impurity concentration as we increase the strength of interaction, anisotropy will increase the percentage change in $h_{c2}(T)$.

The normalized slope of upper critical field versus T/T_c, $h_{c2}(T)$ also behaves the same way as $h_{c2}(T)$ with anisotropy.

I have observed that the local stats within the BCS energy gap is anisotropic.

The response to a weak transverse electromagnitic gield is studied for an isotropic superconductor. The response function agrees with equation (16) of K. Maki (54). In the limit of $q_o \rightarrow 0$, the equation (3.117) reduced to that of Chaba (55).

The Kondo effect of some of our problems is also investigated.