CONCLUSIONS AND OUTLOOKS

Our major findings in compound semiconductors are listed in the following. The effects of covalent bonding on the momentum densities in elemental and compound semiconductors are same. The bonding along (111) direction is \((p,p)\sigma\) type and along (110) direction it is \((p,p)\pi^*\) type. The effect of ionicity is to reduce the anisotropies in both CP and ACPAR data compared to elemental semiconductors because ionicity introduces more tightly bound orbitals which are isotropic in nature. The effect of positron wavefunction is to increase the anisotropies in the low momentum region because of its anisotropic behaviour in the interstitial positions. The shift in zero positions of the autocorrelation functions of ACPAR data from the actual lattice positions is mainly due to the anisotropic positron wavefunctions. The \(B(r)\) functions extend to much higher positions than CP data because the positron wavefunction is large in the interstitial positions. Although the individual zero positions are shifted from the actual positions, the separation of the zero shifts correspond to the actual lattice spacings. This suggests that the electron-positron pair wavefunction follows the periodicity of the lattice. The amplitude of the oscillations is reduced in compound semiconductors because the tightly bound orbitals coming from the ionic bond effects have less overlap with each other. The reconstructed \(\rho_{110}^2(p)\) and \(\rho_{110}(p)\) shows that there is enhancements at the zone boundary and dehancement at the Umklapp region.

Although the present findings have revealed a lot of informations of the nature of the momentum density in compound semiconductors, yet some open problems still exists. So far no CP and ACPAR calculations have been made in compound semiconductors using the self-consistent band structure method. Hence the experimental results suffer to have the quantitative explanations. We hope the present
work will stimulate the theoreticians to do calculations so that the experimental data can be better interpreted and the electron structure can be understood in a better way.

The reconstructed $\rho(p)$ had oscillations in the low momentum region, which came from the long-slit geometry. Hence the 2D ACPAR measurements with low temperature are required. This will not only give us the detailed nature of the bonding along different directions, but also will be helpful in studying the many-body correlation effects. Moreover, the LCW folding and its reconstruction can be done. Such data are highly required both in elemental and compound semiconductors.

Unlike in metals where the working formula exists for electron-positron many body interactions, in semiconductors such formula are absent. Only a speculation of the enhancement and dehancement is done so far by Fujiwara et al. Hence the theoreticians should give a good fitting formula.

The whole thesis work has projected the important ideas on the electron momentum density of the elemental as well as compound semiconductors. The theoretical conjectures are made from the experimental data adequately. We hope the present work will be helpful to create some inspirations for the future studies.