

CHAPTER VI

CONCLUSIONS

In our work, the transport properties of a two-dimensional system with an applied magnetic field in perpendicular direction and imperfections, we found that the degeneracy of the system is lifted out and appear the broadened Landau levels[30]. This arises from the presence of disorder in the system. The degeneracy is also lifted out in the case we apply the electric field in the system in parallel direction. The two cases are quite different, since in the case of an electric field, all states are delocalized, this results is the disappearance of the longitudinal conductivity of an electron in this system. However, in the case of disorder, almost all states are localized then there appears the longitudinal component of conductivity.

We also find that the appearance of the step-like of the transverse conductivity is inherit property of the system. The disorder causes the conductivity curve become smooth out but does not make the curve to be more complicated as seen in the experimental results[9]. Such complication may arise from other interactions of the electrons such as spin-spin interaction, since electrons are all aligned in the same direction by the strong magnetic field, or the spin-orbit interaction since the electrons have the small cyclotron curve the interaction may be effective, or the electron-electron interaction (for this case it is believed to be the origin of the fractional quantum Hall effect[29]). These interaction terms will

bring us to add more degrees of freedom in to our path integrals formulation, but it is not the aim of this thesis.

At higher level of approximation, we have found that the expression of the conductivities become very complicate and it is hard to look for the new physics which may be contain. However, this technique has shown its great advantage over the other that it can give a curve of conductivities which have signs of quantum Hall effect which is the other cannot. Eventhough the result we derived cannot compare to the experimental result, since we have omitted too many interactions in the system, but we think that this calculation scheme has the flexibility to generalize the calculation to include such interactions and can get the result which can be directly with the experimental one.