Abstract

An effort is made to review the Yang potential. The ground state and the wave function by using Bethe's Ansatz are found. The Laughlin's potential is studied and its various properties are investigated. The number of particles in cluster of electrons determines the angular momentum which is used to define the filling factor of the lowest Landau level. A flux factor is added to it so that it gives the desired denominators. The Laughlin state is obtained for any value of the filling factor, p. In all cases, the ground state belongs to nonphysical many-body Hamiltonians. The composite fermion wave function is not the ground state of any known single Hamiltonian. From the angular momentum, we construct the filling factor and then look for the wave function rather than for the Hamiltonian. In this approach the Hamiltonians found are unrealistic. It is possible to make the filling factors agree with the experimental values but the Hamiltonian are not the usual type. The relative angular momentum of two particles L_2 is found to define a projection operator. The filling factor is defined for the state of two particles. The number of particles is g. If another particle approaches it to form a cluster, the modified filling factor is defined. In this methodology the flux quanta cannot be attached to the electron and the projection operator is not linked to the Coulomb Hamiltonian. A monolayer of carbon is called graphene. It exhibits unusual properties in the Hall effect and in the cyclotron resonance. Hence, the Kohn's theorem, which shows that the interactions do not play much role in determining the cyclotron resonance, becomes operative. The Hubbard model has been very successful in explaining the ground state of several electron systems. By using the spin in a particular way, we can obtain new features in the Hubbard model. There is a doubling in the Peierls-Luttinger phase factor and eigen values acquire higher multiplicities than are known for the usual treatment of spin. The flux is distributed on the area of the triangle. The graphene consists of

hexagons of carbon atoms but the Hall effect shows that there are defects on which electrons form clusters so that there is spin wave type behaviour. The Hall resistivity as a function of magnetic field is not a linear function. Hence a suitable theory to understand the Hall effect is formulated. We find that there are phase transitions as a function of temperature. There are lots of fractions of charge which are explained on the basis of spin and orbital angular momentum of the electron. The nano meter size films of graphite also show that the Hall resistivity is non-linear and shows steps as a function of magnetic field. We make an effort to understand the steps in the Hall effect resistivity of graphite with quantum wells formed on the surface. The spin in the clusters is polarized so that it becomes NS which is not 1/2 but depends on the number N, of electrons in a cluster.