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Magnetic field spectra and many-body correlations of spin 3/2 holes confined to GaAs quantum well GEORGE SIMION, YULI LYANDA-GELLER, Purdue University — We consider two dimensional spin 3/2 hole liquid in the presence of a perpendicular magnetic field. Single particle states of Luttinger Hamiltonian are calculated. For the semiclassical limit, the Hamiltonian is separated into the time-symmetric part treated exactly and time-antisymmetric part treated perturbatively. The angular momentum (spin) 3/2 states are characterized by the Landau level index and parity with respect to reflection about the growth direction. The single-particle spectrum exhibits level-crossings as magnetic field is varied, with or without Rashba and Dresselhaus interactions. The numerical calculations were performed for infinite barrier well, finite size barrier, well doped on one side, symmetrically doped well and parabolic well. Cyclotron mass was calculated and its dependence of the type of structure, magnetic field and symmetry of states is discussed and compared with experimental values. Landè effective factor is defined and evaluated. Shubnikov-de Haas oscillations are calculated. Electron-electron interactions are accounted using (time-dependent) mean field theories. An interesting effect is a single-well non-homogeneous spin-texture state. Possible implications of shape of hole spectra for fractional quantum Hall states are explored.

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