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Anomalous magnetoresistance peaks: Evidence for Landau level spin-anticrossing in (110) GaAs two-dimensional hole systems[1]
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— We report anomalous peaks in the longitudinal resistance of (110) GaAs two-dimensional hole systems (2DHS), which we associate with an anticrossing of spin split Landau levels. GaAs hole systems are of research interest due to their heavy mass and strong spin-orbit coupling. With modulated growth conditions, Si can be used as an acceptor for high mobility 2DHS on (110) wafers with mobilities up to $7 \times 10^5 \mathrm{cm}^2/\mathrm{Vs}$ at a hole density of $1.2 \times 10^{11} \mathrm{cm}^{-2}$. Resistance peaks within the $\nu = 1$ minimum of the quantum Hall effect are observed in various samples. We propose that these anomalous peaks arise from an anticrossing of Landau levels with magnetic field. The position of the anticrossing field is independent of top-gate voltage, but can be tuned by illumination. This behaviour is in agreement with self- consistent calculations of the valence band mixing, assuming an illumination dependent background charge in the substrate. Band calculations predict a spin-flip at the anticrossing, which might be exploited to test new spin based device concepts.

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