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Parallel magnetic field induced valley splitting T. GOKMEN, O. GUNAWAN, K. VAKILI, E. P. DE POORTERE, M. SHAYEGAN, Department of Electrical Engineering, Princeton University, Princeton, NJ 08544 — In an 11nm-wide thick AlAs quantum well grown on a GaAs (001) substrate, the two-dimensional electrons occupy two in-plane conduction-band valleys. The Fermi contours for these two valleys are ellipses whose major axes are rotated by 90 degrees. The energy separation between these two valleys at zero magnetic field is normally controlled via the application of in-plane strain along the major axis of one of the valleys. In this talk, through a combination of experimental results and calculations, we demonstrate a novel method for tuning of the valley splitting. Namely, we show that the application of a magnetic field parallel to the major axis of one the ellipses leads to a lifting of the valley degeneracy. This is because the parallel field which, thanks to the finite thickness of the electron layer couples to the electrons' orbital motion modifies the effective masses of the two valleys (in the direction perpendicular to the field direction) by different amounts.

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