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Spin-Valley Phase Diagram of the 2D Metal-Insulator Transition O. GUNAWAN, T. GOKMEN, K. VAKILI, M. PADMANABHAN, E.P. DE POORTERE, M. SHAYEGAN, Princeton University, SHAYEGAN'S GROUP TEAM — It has been recognized that the spin degree of the freedom plays a crucial role in the controversial metal-insulator transition problem in 2D carrier systems. Here, we directly probe the role of another discrete electronic degree of freedom, namely the valley polarization. Using symmetry breaking strain to tune the valley occupation of a 2D electron system in an AlAs quantum well, together with an applied in-plane magnetic field to tune the spin polarization, we map out a spin-valley phase diagram for the 2D metal-insulator transition. The insulating phase occurs in the quadrant where the system is both spin- and valley- polarized. This observation establishes the equivalent roles of spin and valley degrees of freedom in the 2D metal-insulator transition.

Oki Gunawan
Princeton University

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