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Manipulation of coherent spin dynamics using magnetic focusing in spin-orbit-coupled nanostructures SHUN-TSUNG LO, CHIN-HUNG CHEN, JU-CHUN FAN, National Cheng Kung University, LUKE SMITH, University of Cambridge, GRAHAM CREETH, University College London, CHE-WEI CHANG, National Cheng Kung University, MICHAEL PEPPER, University College London, JONATHAN GRIFFITHS, IAN FARRER, HARVEY BEERE, GEB JONES, DAVE RITCHIE, University of Cambridge, TSE-MING CHEN, National Cheng Kung University — Spin-orbit interaction is one of the key ingredients to achieving full control of coherent spin dynamics without relying on ferromagnetism. Previously, the inability to spatially separate electrons with up and down spins has limited the ability to track and use their individual spin dynamics, and hampered the versatility of a spin-orbit-coupled material in both fundamental research and device design. In this work, we demonstrate that the spatial spin splitting of a coherent beam of electrons can be realized using the interplay between an external magnetic field and spin-orbit interactions in semiconductor nanostructures. The technique of transverse magnetic focusing is utilized to probe the spin separation. Furthermore, our ability to tune spin-orbit interactions not only makes the separation between them controllable but also enables us to individually manipulate the coherent spin dynamics of each spin species and hence their correlation. This spin focusing technique paves a way to access and manipulate two spin species simultaneously, which could be essential for spin-based quantum information processing.

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