OFFICIAL ABSTRACT and CERTIFICATION

Epitaxial Growth and Characterization of a Novel (001) Cd3As2 Thin Film on a Lattice Matched Buffer

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Cadmium arsenide (Cd3As2) is a three-dimensional (3D) Dirac semimetal that has been shown to exhibit electrical transport properties such as high carrier mobility, ultrahigh magnetoresistance, and topological surface states. This makes Cd3As2 a promising candidate for use in future electronic technologies such as quantum computers, spintronics devices, photo and infrared detectors, and more. While previous experiments have studied epitaxially grown Cd3As2 heterostructures, the characteristics of (001) oriented films grown on lattice matched buffer layers have yet to be explored. This project investigates the growth and electronic properties of Cd3As2 films grown on an Al(.42)In(.58)Sb buffer layer, deposited on a GaSb substrate. This study reveals that this novel heterostructure can be grown successfully and has a similar carrier mobility and slightly lower carrier density than films with lattice mismatched buffer layers. Shubnikov-de Haas oscillations and the onset of the quantum Hall effect are also observed. These findings allow for a better understanding of Dirac semimetals and pave the way for new materials with impactful electronic applications.

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