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Observation of orientation- and k-dependent Zeeman spin-splitting in hole quantum wires on (100)-oriented AlGaAs/GaAs heterostructures

ADAM MICOLICH, JASON CHEN, OLEH KLOCHAN, ALEX HAMILTON, THEODORE MARTIN, LAP-HANG HO, School of Physics, University of New South Wales, Sydney NSW 2052, Australia, ULRICH ZUELICKE, Institute of Fundamental Sciences, Massey University, Private Bag 11 222, Palmerston North 4442, New Zealand, DIRK REUTER, ANDREAS WIECK, Angewandte Festkörperphysik, Ruhr-Universität Bochum, D-44780 Bochum, Germany — We will present our recent study the Zeeman spin-splitting in hole quantum wires oriented along the [011] and $[0\bar{1}1]$ crystallographic axes of a high mobility undoped (100)-oriented AlGaAs/GaAs heterostructure. Our data shows that the spin-splitting can be switched ‘on’ (finite g^*) or ‘off’ (zero g^*) by rotating the field from a parallel to a perpendicular orientation with respect to the wire, and the properties of the wire are identical for the two orientations with respect to the crystallographic axes. We also find that the g -factor in the parallel orientation decreases as the wire is narrowed. This is in contrast to electron quantum wires, where the g -factor is enhanced by exchange effects as the wire is narrowed. This is evidence for a k -dependent Zeeman splitting that arises from the spin- $\frac{3}{2}$ nature of holes.

Adam Micolich
The University of New South Wales

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