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Searching for Majorana Zero-Energy Modes in Semiconductor Nanowires PETER O'MALLEY, PEDRAM ROUSHAN, BORZOYEH SHOJAEI, UC Santa Barbara, ROMAN LUTCHYN, Microsoft Station Q, CHRIS PALMSTROM, JOHN MARTINIS, UC Santa Barbara — Majorana fermions are proposed elementary particles with the unique property of being their own antiparticle, whose discovery remains elusive. Because of their non-Abelian statistics, Majorana fermions provide a promising opportunity to realize fault-tolerant topological quantum computation. Recently, semiconductor nanowires have been proposed as a possible platform for realizing Majorana physics in solid state systems. An s-wave superconductor inducing the proximity effect in a one-dimensional semiconductor nanowire would create chiral p-wave superconductivity in the nanowire; this superconductor would have Majorana modes as zero-energy excitations. We use nanofabrication techniques to create such nanowires out of MBE-grown two-dimensional electron gas formed in III-V semiconductor heterostructures. We present measurements which show the promise of this approach to creating and controlling Majorana excitations.

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