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InAs/GaSb quantum wells: quantum spin Hall effect and topological superconductivity MATTHIAS SITTE, KARIN EVERSCHOR-SITTE, ALLAN MACDONALD, Univ of Texas, Austin — In recent years, topological insulators (TIs) have attracted great attention as a new quantum state of matter. The first experimental 2D TIs were HgTe/CdTe quantum well heterostructures. Recently, another semiconducting system – the InAs/GaSb quantum well heterostructure – was shown to be a 2D TI as well. These semiconducting heterojunctions have many advantages compared to HgTe/CdTe systems, including continuously tunable band structure via electric fields and stronger proximity coupling to superconductors. Proximity coupling of a 2D TI and an ordinary superconductor gives rise to one-dimensional topological superconductivity which supports non-local excitations known as Majoranas that can be used for topologically protected quantum computing. We perform empirical tight-binding calculations on these systems, studying the topological phases and their properties. With this knowlegde, we then extend our theory to study the proximity effects when InAs/GaSb quantum wells are coupled to a superconductor.

Matthias Sitte
Univ of Texas, Austin

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