**Idaho State University
Physics Colloquium**

***A Proximity-Induced Topological Phase in Bilayer Graphene***

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Spin orbit coupling (SOC) is the key to realizing time-reversal invariant topological phases of matter. Famously, SOC was predicted by Kane and Mele to stabilize a quantum spin Hall insulator; however, the weak intrinsic SOC in monolayer graphene has precluded experimental observation. Here, we exploit a layer-selective proximity effect---achieved via van der Waals contact to a semiconducting transition metal dichalcogenide--to engineer SOC in ultra-clean bilayer graphene. Using high-resolution capacitance measurements to probe the bulk electronic compressibility, we find that SOC leads to the formation of a distinct incompressible, gapped phase at charge neutrality. The experimental data agrees quantitatively with a simple theoretical model in which the new phase results from SOC-driven band inversion. In contrast to Kane-Mele SOC in monolayer graphene, the inverted phase is not expected to be a time reversal invariant topological insulator. Electrical transport measurements, however, reveal that the inverted phase has a conductivity ∼e2/h, which is suppressed by exceptionally small in-plane magnetic fields. The high conductivity and anomalous magnetoresistance are consistent with theoretical models that predict helical edge states within the inverted phase. Our results pave the way for proximity engineering of strong topological insulators as well as correlated quantum phases in the strong spin-orbit regime in graphene heterostructures.

**Monday, February 1 2021**
**Via Zoom(**<https://isu.zoom.us/j/86590672446>**)
4:00 – 4:50 pm**