PCSI

Room Redondo - Session PCSI-ThM2

Si Qubits and Spin Centers

Moderator: Christopher Palmstrom, University of California, Santa Barbara

10:50am **PCSI-ThM2-29 Interface-Dependent Valley Splitting in Si Quantum Dot Qubits**, ***Mark Friesen,*** University of Wisconsin-Madison **INVITED**

Degenerate “valleys” in the silicon conduction band represent a potentially dangerous degree of freedom that can compete with “spin” as the dominant quantum variable in quantum dot qubits. Scaling up to large numbers of qubits therefore requires controlling the valley energy splitting. Unfortunately, this splitting depends strongly on atomistic properties of the interface, including interface sharpness, roughness and various types of disorder, which are unavoidable. In this talk, I will describe our current understanding of the wide variability observed in valley splitting measurements, even in devices fabricated 100 nm apart on the same chip. I will show that typical strategies for mitigating this variability are often only weakly effective, and that ubiquitous alloy disorder in the SiGe quantum well barriers plays a significant role in determining the valley splitting in many cases of interest. I will conclude by suggesting alternative strategies for controlling the valley splitting in future generations of devices.

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11:30am **PCSI-ThM2-37 Experimental Signature of Topologically Protected Surface States in a New-Type Centrosymmetric Superconductor $PdBi_2$**, ***Jinbang Hu,*** Norwegian University of Science and Technology (NTNU), Norway*; J. Wells,* University of Oslo (UiO), Norway

Topological superconductors (TSCs) is a novel quantum phase of matter characterized by a fully gapped bulk state and gapless boundary states hosting exotic Majorana fermions. [1] The prospect of harboring vortex confined Majorana zero mode (MZM) for potential applications in quantum computation has attracted considerable experimental research interest. Recently, topologically protected surface states in a centrosymmetric layered superconductor, β-PdBi2 was confirmed by Sakano et al,[2] and the corresponding possible spin triplet superconducting phases were examined and reported by Sun et al. [3]

In this work, we demonstrate how high-quality PdBi2 samples growing layer-by-layer to the bulk phase by molecular beam epitaxy (MBE) and measured the atomic and electronic structures by scanning tunnelling microscopy (STM) and angle-resolved photoemission spectroscopy (ARPES) for comparison with first principles calculations. As compared to the β-PdBi2 bulk single crystal hosting a topologically protected surface Dirac cone band with the binding energy of the Dirac point around 2.4 eV below Fermi level. Our results shift the Dirac point up to ~1.1 eV is an important step towards realizing MBS in this robust system.

11:35am **PCSI-ThM2-38 PCSI Closing Remarks**,

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