**PCSI**

**Room Ballroom South - Session PCSI-SuA**

## The Future of Computing

**Moderator:** Christopher Palmstrøm, University of California, Santa Barbara

3:00pm **PCSI-SuA-1 Chiraltronics: Chiral Domain Wall and Anti-skyrmion Data Storage Elements for High Performance Racetrack Memories*, Stuart Parkin,*** Max Planck Institute, Germany **INVITED**

Over the past few years there have been remarkable discoveries in spin-based phenomena that rely on spin-orbit coupling that could spur the development of advanced magnetic memory devices1-3. One of the most exciting of these is Racetrack Memory1,4 that stores digital data in the form of the presence or absence of chiral domain walls. Recent discoveries in the emerging field of chiraltronics makes possible the current induced motion of series of chiral domain walls at high speeds that exceed 1 km/s in atomically engineered racetracks2. The same type of Dzyaloshinskii-Moriya exchange interactions that stabilize chiral Néel domain walls in such racetracks also enable the formation of topological spin textures such as spin helices and skyrmions. Recently we have discovered magnetic antiskyrmions in a tetragonal Heusler compound, using Lorentz transmission electron microscopy5. Such antiskyrmions are potential storage elements in racetrack memories. These recent discoveries in chiraltronics makes Racetrack Memory extremely attractive as a dense, high performance, low energy consuming, non-volatile memory technology1 that could make computing systems more compact and yet more powerful.

1. Parkin, S. S. P. & Yang, S.-H. Memory on the Racetrack. *Nat. Nano.* **10**, 195-198, (2015).

2. Yang, S.-H., Ryu, K.-S. & Parkin, S. S. P. Domain-wall velocities of up to 750 ms−1 driven by exchange-coupling torque in synthetic antiferromagnets. *Nat. Nano.* **10**, 221-226, (2015).

3. Ryu, K.-S., Thomas, L., Yang, S.-H. & Parkin, S. S. P. Chiral spin torque at magnetic domain walls. *Nat. Nano.* **8**, 527–533, (2013).

4. Parkin, S. S. P., Hayashi, M. & Thomas, L. Magnetic Domain-Wall Racetrack Memory. *Science* **320**, 190-194, (2008).

5. Nayak, A. K. et al. Magnetic antiskyrmions above room temperature in tetragonal Heusler materials. *Nature* **548**, 561-566, (2017).

3:40pm **PCSI-SuA-9 Neuromorphic Computing*, Angel Yanguas-Gil,*** Argonne National Laboratory **INVITED**

4:20pm **PCSI-SuA-17 Panel Discussion I**,

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