Quantum Spin Coherence Workshop, Monday-Tuesday, 14-15 Sept 2020

Held prior to the MagLab Users Committee (Zoom) Meeting, Wednesday-Friday (16-18 Sept 2020). Organized by UF MagLab AMRIS and High B/T Facilities in Gainesville, with IT connections handled by the MagLab in Tallahassee.

**Motivation:** A vision for computing of the future involves the development of functional quantum materials for electronic devices that leverage long-lived coherences of quantum states. National and international science funding agencies have embraced this vision due to the expanding success being reported for quantum computing. The investigation of these complex systems involves multi-messenger approaches that include ESR-NMR tools probing the quantum nature of these systems at the extremes of temperature, magnetic field, and frequency domains. Ultimately, the devices may operate in low magnetic fields and at high temperatures, but the new systems will need to be engineered to avoid dissipation mechanisms that limit the quantum coherence. Consequently, detailed knowledge of perturbative terms, typically considered to be too small to be included in previous work, need to be understood, and MagLab tools at the extremes of cold temperature and high magnetic field are poised to lead fundamental research in this direction. This Workshop is assembled to provide a broad, diverse overview of some efforts to control and evaluate quantum spin coherence and to envision future work that may be performed at MagLab facilities.

**Day 1  Monday, 14 September, Plenary Talks (35 min plus 10 min for questions)**

**NOTE: All times are EDT in the USA.**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
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<tbody>
<tr>
<td>0930 hrs</td>
<td>Zoom set up and testing</td>
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<tr>
<td>1000 hrs</td>
<td><strong>Welcome and “Spin” of the Workshop</strong>                  Greg Boebinger, Joanna Long, Mark Meisel</td>
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<tr>
<td>1005 hrs</td>
<td>Overview of the Science Drivers of 2023-2027 Renewal       Laura Greene</td>
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| 1010 hrs | **Malcolm Levitt (University of Southampton, UK)**                  
*Non-Equilibrium Spin Dynamics: Physical Bounds, Unitary Bounds, Master Equations and Algorithmic Cooling*  
Refs: [https://doi.org/10.1063/5.0006742](https://doi.org/10.1063/5.0006742), [https://doi.org/10.1016/j.jmr.2019.106645](https://doi.org/10.1016/j.jmr.2019.106645), and [https://doi.org/10.1103/PhysRevLett.120.266001](https://doi.org/10.1103/PhysRevLett.120.266001) |
| 1045 hrs | Questions                                                          |
| 1055 hrs | Break                                                              |
| 1110 hrs | **David Awschalom (University of Chicago)**                     
*Spin Dynamics and Quantum Information Processing in the Solid State*  
Refs: [https://science.sciencemag.org/content/early/2020/08/12/science.abc5186](https://science.sciencemag.org/content/early/2020/08/12/science.abc5186) and [https://arxiv.org/abs/2005.07602](https://arxiv.org/abs/2005.07602) |
| 1145 hrs | Questions                                                          |
| 1155 hrs | Break                                                              |
| 1210 hrs | **Enrique del Barco (University of Central Florida)**              
*Spin Pumping from an Insulating Antiferromagnet*  
Ref: [https://science.sciencemag.org/content/368/6487/160.abstract](https://science.sciencemag.org/content/368/6487/160.abstract) |
| 1245 hrs | Questions                                                          |
| 1255 hrs | Summary Joanna Long, Mark Meisel                                   |
| 1300 hrs | End of Day 1 Session Social Hour (optional)                        |
| 1400 hrs | Adjourn                                                             |
Quantum Spin Coherence Workshop, Monday-Tuesday, 14-15 Sept 2020

Day 2  Tuesday, 15 September, Plenary Talks (35 min plus 10 min for questions)

NOTE: All times are EDT in the USA.

0930 hrs  Zoom set up and testing

1000 hrs  Welcome and “Spin” of the Workshop  Greg Boebinger, Joanna Long, Mark Meisel

1005 hrs  Overview of the Science Drivers of 2023-2027 Renewal  Laura Greene

1010 hrs  Carlos A. Meriles (City College of New York)
The Interplay between Spin and Charge in Nitrogen-Vacancy Centers in Diamond

1045 hrs  Questions

1055 hrs  Break

1110 hrs  Johannes Pollanen (Michigan State Univ.)
Hybrid QIS systems based on superconducting qubits, superfluids, and electrons on He
Ref: https://doi.org/10.1103/PhysRevA.101.012336

1145 hrs  Questions

1155 hrs  Break

1210 hrs  Joe Zadrozny (Colorado State Univ.)
Synthetic Command of Nuclear and Electronic Spins in Molecules
Refs: https://doi.org/10.1021/acs.inorgchem.0c00244 and https://doi.org/10.1016/j.poly.2019.114171

1245 hrs  Questions

1255 hrs  Summary  Joanna Long, Mark Meisel

1300 hrs  End of Workshop → Social Hour (optional)

1400 hrs  Adjourn