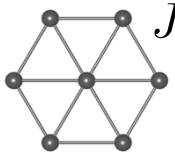
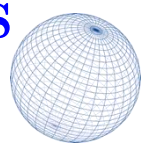
Mourigal Lab Research: Quantum Magnetism

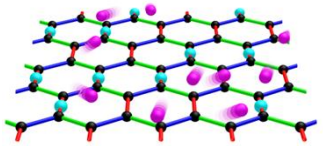
Idea

magnetic material

$\Leftrightarrow$ $\mathcal{H} = \sum_{(ij)} \hat{\mathbf{S}}_i J_{ij} \hat{\mathbf{S}}_j$ Heisenberg model

$\Leftrightarrow$  J_{ij} $\otimes$  $\hat{\mathbf{S}}$

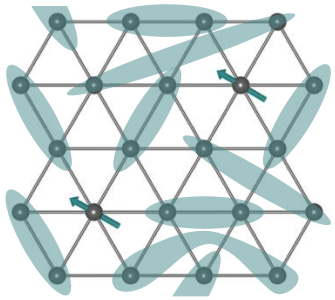
lattice-space spin-space

$\Leftrightarrow$ 

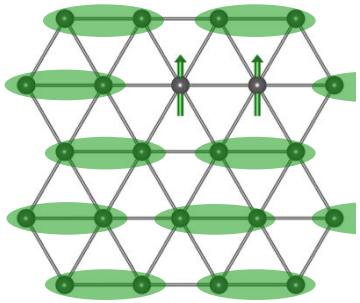
emergent quantum behavior

Challenge

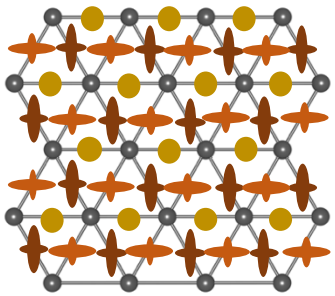
topological order — entanglement — local order — disorder



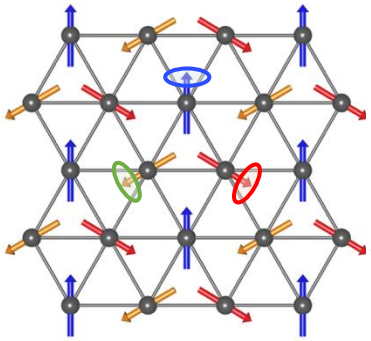
Quantum spin liquid



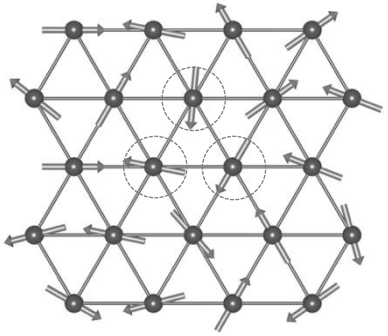
Quantum paramagnet



Quadrupolar order

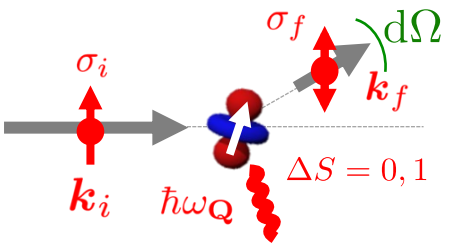


Dipolar order

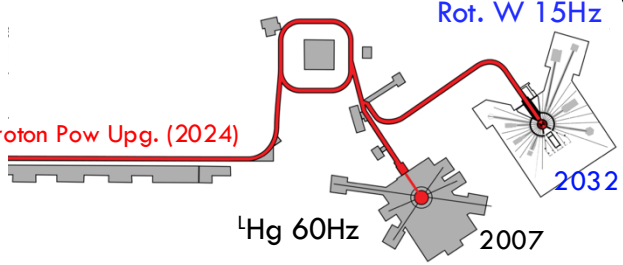


Paramagnet

Approach

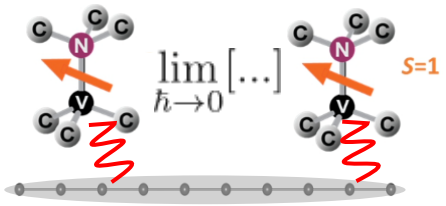


Inelastic neutron scattering



ORNL Spallation Neutron Source

Applications?



Transduction of quantum information

Special Problems Course

Course Information

- **Instructor:** Martin Mourigal (mourigal@gatech.edu)
- **Course Prefix and Number:** PHYS 8901 MM
- **Term:** Summer 2026

Course Description

This course provides academic credit for independent studies under the direction of a faculty member. The scope and direction of the studies are determined by the student (or small group of students) in consultation with the course instructor.

Course Learning Outcome

By enrolling in this course, students will gain experience in performing independent studies on topics that are not taught in a formalized course setting.

Required Course Materials

No textbooks or materials are required. Resources for research are determined in consultation with the instructor.

Grading Policy

This course is graded on a letter grade basis.

The grade will be assigned based on agreed upon objectives commensurate with the difficulty and scope of the project, the number of credit hours, as well as the technical proficiency of the student. It is the joint responsibility of the instructor and the student to discuss expectations and how meeting or not the expectations affects the final grade. The grading process will be clearly articulated to the student to allow reasonable prediction progress towards the final grade throughout the semester.

Attendance Policy

This course does not include scheduled class meetings. The frequency and format of student–faculty contact are determined by mutual agreement and are consistent with the number of credit hours for which the student is enrolled.

Academic and Research Honesty/Integrity Statement

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review the Student Code of Conduct and the Academic Honor Code, especially Appendix A: Graduate Addendum to the Academic Honor Code.

Students are expected to perform research in an ethical and responsible manner. All Doctoral and Master's Thesis students are required to take the Responsible Conduct of Research training, and it is expected that students abide by the principles taught in that training while performing research.

Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Allegations of scientific or scholarly misconduct are handled in accordance with the procedures outlined by the Policy for Responding to Allegations of Scientific or Other Scholarly Misconduct.

Core IMPACTS

Not applicable

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Student-Faculty Expectations

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations articulates some basic expectations that you can have of me and that I have of you. Additional information for research-related work is given in The Expectations of Advisors and Advisees. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.