Symposium Frustrated Quantum Systems (SYFQ)

Martin Dressel
University of Stuttgart
Pfaffenwaldring 57
70550 Stuttgart, Germany
dressel@pi1.physik.uni-stuttgart.de

The field of quantum magnetism originates in Werner Heisenberg's seminal contribution "Zur Theorie des Ferromagnetismus" in Zeitschrift für Physik 49, 619-636 (1928). Theoretical investigations of frustrated lattice by Phil W. Anderson in the 1970s opened an increasingly active field, that became even more popular after quantum spin liquids could be realized experimentally. Recent advances and novel methods in theory and in experiment lead to totally new aspects in the field of frustrated quantum magnetism. Through the targeted variation of geometry and interactions, the parameter space can be systematically explored, in order to check theoretical predictions. Research on artificial quantum systems and natural solids are mutually beneficial.

Overview of Invited Talks and Sessions

(Lecture hall ZHG008)

Invited Talks

SYFQ 1.1	Wed	10:45–11:25	ZHG008	**Detection of anyon braiding through pump-probe spectroscopy** — •Nandini Trivedi
SYFQ 1.2	Wed	11:25–12:05	ZHG008	**Fate of quantum spin liquid in 2D** — •Alexander A. Tsirlin
SYFQ 1.3	Wed	12:05–12:45	ZHG008	**Quantum disorder and quantum critical states in organic systems with triangular lattices** — •Kazushi Kanoda

Sessions

SYFQ 1.1–1.3	Wed	10:45–12:45	ZHG008	**Frustrated Quantum Systems**

SYFQ 1: Frustrated Quantum Systems

Time: Wednesday 10:45–12:45 Location: ZHG008

Invited Talk SYFQ 1.1 Wed 10:45 ZHG008
Detection of anyon braiding through pump-probe spectroscopy — •Nandini Trivedi — The Ohio State University, 191 W. Woodruff Avenue, Columbus, OH 43210, USA

I will discuss how pump-probe non-linear spectroscopy provides a distinctive new probe of quantum spin liquid states, beyond the inconclusive broad features observed in single spin flip inelastic neutron scattering. While the linear response signal oscillates and decays with time, the amplitude of the nonlinear signal for $\chi(3)$XZZ signal features a linear-in-time enhancement at early times. Here XZZ are the directions of pump, probe, and measurement magnetic fields. The comparison between $\chi(3)$XZZ, which involves the non-trivial braiding of electric e and magnetic m anyons, and $\chi(3)$XXX that involves the trivial braiding of the same types of anyons, serves to distinguish the braiding statistics of anyons. We support our analysis by constructing a hard-core anyon model with statistical gauge fields to develop further insights into the time dependence of the pump-probe response.

Invited Talk SYFQ 1.2 Wed 11:25 ZHG008
Fate of quantum spin liquid in 2D — •Alexander A. Tsirlin — Felix Bloch Institute for Solid-State Physics, Leipzig University, Germany

Stabilization of the long-range-entangled state of quantum spin liquid is one of the main allures of frustrated spin systems. In this talk, I will review recent progress in the experimental realization of this exotic state in quasi-2D magnets with the triangular and kagome geometries. I will highlight the role of structural disorder and the delicate competition between quantum spin liquid and random singlet states as two possible scenarios for the frustrated magnet. The microscopic pre-conditions for the spin-liquid formation and its eventual spectral manifestations will be presented.

Invited Talk SYFQ 1.3 Wed 12:05 ZHG008
Quantum disorder and quantum critical states in organic systems with triangular lattices — •Kazushi Kanoda — Max Planck Institute for Solid State Research, Stuttgart, Germany — University of Stuttgart, Germany — University of Tokyo, Japan

The exploration of quantum materials that exhibit macroscopic manifestations of quantum fluctuations and their associated novel properties is currently a focal point in condensed matter physics. Geometrically frustrated lattices, where interparticle interactions conflict with one another, serve as platforms for observing such phenomena. In this symposium, we will review the current status of research on quantum spin liquids (QSLs), with a focus on the triangular-lattice organic system κ-(BEDT-TTF)2Cu2(CN)3. Recent experimental results suggest that this system exhibits (neutral) Fermi-liquid-like behavior, followed by an instability of quantum critical nature at lower temperatures. Next, we will also discuss a metallic and superconducting system, κ-(BEDT-TTF)4Hg2.89Br8, which is a candidate for the doped QSL. In this case, we show both the non-Fermi liquid behavior and the quantum critical characteristics of the normal state, along with its superconducting nature, characterized by a pseudogap and reduced superfluid density. Finally, we will address the interrelationships between the low-temperature phases present in these two systems.