| Phys 4309 | QUANTUM SOLID STATE MAGNETISM | (CR3) |
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| Preq. | Phys 3402 | |

**Objective**

*Learn the modern theoretical foundations used to describe and study collective magnetic phenomena in the Solid State.*

**Syllabus**

Magnetic response and correlation functions, analytic properties, fluctuation-dissipation theorem, experimental methods to measure static and dynamic correlations, magnetic response and correlations in metals, diamagnetism and paramagnetism, magnetic ground states: ferromagnetism, spin density waves, excitations in metals, spin waves, experimental examples, magnetic response and correlations of magnetic ions in crystals: quantum numbers and effective Hamiltonians, application of group theory to classifying ionic states, experimental case studies, magnetic response and correlations in magnetic insulators, effective Hamiltonians, magnetic order and propagation vector formalism., the use of group theory to classify magnetic structures, determination of magnetic structures from diffraction data, excitations: spin wave theory and beyond, Triplons, measuring spin wave spectra.

***Recommended Books***

1. *Quamtum Theory of Magnetism, by W. Nolting, Springer, (2009)*
2. *Quantum Theory of Magnetism, by R. M. White, Springer, (2006)*
3. *Quantum Magnetism, U. Schollwöck and J. Richter, Springer, (2004)*
4. *Introduction to Magnetic Materials by B. D. Cullity & C. D. Graham, 2nd Ed. (2008).*