PHYSICS & ASTRONOMY COLLOQUIUM
UNIVERSITY OF WISCONSIN – STEVENS POINT
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Exploring Quantum Many-Body Physics with Cold Dipolar Atoms

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Abstract: Remarkable experimental advances in the past few decades have paved the way for a new era of ultra-cold physics. Experimentalists can now cool large samples of atoms down to temperatures where quantum mechanical effects dominate, and control their bulk geometrical structure and microscopic interactions with ease. The result is a wide open testing ground for quantum many-body physics. This talk will provide an overview of the important concepts and methods that form the foundations of this field, before steering the discussion to Bose gases, or gases with constituents that obey Bose-Einstein statistics. At ultra-cold temperatures, gases of bosons condense into a single macroscopic quantum mechanical state, forming a Bose-Einstein condensate. One of the more interesting properties of Bose-Einstein condensates is that they are superfluid, and can exhibit dissipationless flow. If the bosons possess large dipole moments, their interaction character changes significantly, as does their collective superfluid behavior. The talk will discuss some of the theoretical and computational tools used to model Bose-Einstein condensates, demonstrate how dipolar interactions play a profound role in the basic properties of these novel superfluids, and provide an outlook for the future of this exciting field.