Quantum gases of ultracold atoms are a powerful resource to address fundamental questions and realize novel paradigms in few- and many-body quantum physics. The potential of such systems is becoming ever more enabling as scientists acquire an increasingly fine control over optical manipulation (e.g. cooling, trapping, and state preparation) and inter-particle interactions.

Recently, a novel class of atomic species, possessing a large magnetic character and an extraordinary rich atomic spectrum, is entering the stage, offering a new conceptual twist for the field. In our laboratories, we have realized the first dipolar Bose-Einstein condensate and Fermi gas, using a magnetic rare-earth species: Erbium. In the quantum regime, Er atoms possess interparticles interactions of genuinely different nature, in which the ordinary magnetically-tunable contact interaction combines with the long-range and anisotropic magnetic dipolar interaction. The mere existence and competition between these two sources of interactions dictate the physics at play, disclosing a variety of intriguing, yet counter-intuitive, quantum phenomena and phase of matter.

This talk will provide an overview from the Innsbruck prospective of some fascinating dipolar phenomena with dipolar quantum gases (Er) and the newly-achieved heteronuclear dipolar mixtures (Er-Dy).