The Discreet Charm of Dipolar Quantum Matter near Absolute Zero Temperature

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Approaching temperatures near the absolute zero, i.e. the lowest temperature in the whole universe, the atoms develop extreme behaviors, which challenge our understanding. In this extreme regime, the atoms assume exceptional behaviors and form a new type of matter, which is now governed by the laws of quantum mechanics.

In this regime, the interactions between many particles dictate the quantum behavior. Highly magnetic atoms, such as Erbium, endow a novel type of interaction to the quantum behavior, namely the dipole-dipole interaction (DDI). Because of its long-range nature and an isotropic character, the DDI imprints genuinely novel properties at the many- and few-body level. The behavior of these systems is fundamental to understand nature and quantum physics, and reserves us every day fascinating and counterintuitive surprises.

This talk will provide an overview of the fascinating dipolar phenomena from the Innsbruck prospective, ranging from the first-produced quantum gas of Er, to the observation of chaotic scattering and the formation of a quasi self-bound droplet state in analogy with the He case.