Making and exploring LiCr and Cr_2 paramagnetic dimers in the ultracold regime

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Quantum mixtures of resonantly interacting atoms not only provide appealing frameworks for the quantum simulation of a variety of few- and many-body phenomena [1], but currently also represent the most favorable starting point to realize quantum gases of diatomic molecules. Here, I will discuss recent and ongoing experimental activities of our lab that focus on novel mixtures of lithium alkali and chromium transition-metal atoms [2,3].

I will first describe the experimental strategies to produce a high phase-space density gas of paramagnetic $^6Li^{53}Cr$ bosonic molecules, the thorough characterization of their properties in weakly-bound levels, and promising pathways towards their absolute ground state [4]. I will then discuss more recent, still ongoing studies on the production of both bosonic and fermionic LiCr dimers, as well as on the determination of mass-scaled models for ultracold collisions in Li-Cr and Cr-Cr systems, providing first benchmarks of quantum chemistry methods for these challenging compounds.

Figure 1: Overview of the PoLiChroM lab in Florence.

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