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Comprehensive Characterization of a State-of-the-Art Apparatus for Cold Electromagnetic Dysprosium Dipoles

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We developed a new advanced ultra-cold Dysprosium (Dy) apparatus, which incorporates a quantum gas microscope (QGM) with a resolution of a quarter micrometer. The QGM and the cooling and trapping regions are within the same vacuum glass vessel assuring simple atom transport between them. We demonstrate the essential experimental steps of laser and evaporative cooling, lattice loading, transporting and precise positioning of a cloud of the bosonic isotope 164Dy at the QGM focal plane. Preliminary basic characterization of the QGM and future plans in enabling its full capacity are outlined. We also present a feasible platform for simulating complex spin models of quantum magnetism, such as XYZ model, by exploiting a set of closely spaced opposite parity levels in Dy with a large magnetic and electric dipole moment.

Primary authors: Dr KIRILOV, Emil (senior scientist); Mr ANICH, Gregor (doctoral student); Prof. GRIMM, Rudolf (Universitat Innsbruck)

Presenter: Dr KIRILOV, Emil (senior scientist)

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