When the complex nature of atoms can really make a difference:

ultracold erbium and dysprosium for quantum simulation

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Abstract

Since its creation, the field of ultracold atoms has been through fantastic developments. Some of the most recent include the development of quantum-gas microscopes, atom tweezers, and various forms of interaction engineering. Each of these experimental advances has allowed new quantum phenomena to be accessed and observed. A further important development is based on the use of more exotic atomic species, whose peculiar atomic properties have allowed to broaden the horizons of investigation. This talk aims to retrace the new opportunities that have emerged from the use of quantum gases composed of the strongly magnetic erbium and dysprosium atoms from the perspective of the Innsbruck experiments. Thanks to their large magnetic moment, these species exhibit a large dipolar interaction that has allowed us to observe rotonic excitations, quantum droplets, and supersolid states. Moreover, their dense atomic spectrum has also made possible to implement new optical manipulation schemes, and more recently the observation of an Hz-wide transition in the telecom frequency region promises new possibilities in quantum optics.

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