量子物理学・ナノサイエンス第 60 回特別セミナー

Droplet crystal ground states of a dipolar Bose gas

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日程　：　12 月 4 日（火）14:00–15:30

場所　：　本館 1 階 156 物理学系輪講室

概　要

Dipolar Bose-Einstein condensates are produced using highly magnetic atoms such as dysprosium and erbium. In the dipole dominated regime, where the long-ranged dipole-dipole interaction dominates over the short-ranged contact interaction between atoms, the system is unstable to collapse. It has been found that in this regime quantum droplets form, stabilized by beyond mean-field quantum fluctuations.

These quantum droplets can be completely self-bound, even in the absence of any confinement. I will discuss the excitations of these droplets and consider the effect of harmonic confinement on the ground state phase diagram. Notably that droplet crystal states emerge in which a set of droplets arrange into a lattice pattern that breaks the rotational symmetry of the trap. We have developed an analytic model that describes small droplet crystals and can be used to qualitatively describe the phase diagram obtained by full numerical calculations. We show that in certain regimes a coherent low-density halo surrounds the droplet crystal giving rise to a novel phase with localized and extended features.

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2018 年 12 月