凝縮系物理学ゼミナール

Condensed Matter Seminar

Location: Room 413, School of Science Bldg. 5 (理学部 5 号館 413 号室)
Date: 13:30-15:00, Wednesday, 13 April 2011

“Phase structure and low-energy excitations in spinor Bose-Einstein condensates”

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Abstract:

Physics of ultracold atomic gases has matured into a versatile field of research. Most of atomic species utilized in the experiments have spin degrees of freedom, and the optical trap enables us to study a Bose-Einstein condensate (BEC) with spin degrees of freedom, that is, spinor BEC. Since the experimental realization was achieved, a spinor BEC has attracted interest and become one of the hottest branches coupled with the fact that the theoretical studies go hand in hand with the experimental studies. In this talk, we discuss phase structure and low-energy excitations in a spinor BEC based on the theory of weakly interacting Bose gases. Our foci are on the Lee-Huang-Yang corrections that are the first quantum corrections of physical quantities, and on the Nambu-Goldstone (NG) modes that are the dominant degrees of freedom to determine the low-energy behavior of the system. In connection with the latter focus, it is shown that quasi-NG modes, which were introduced in high-energy physics, emerge in a spin-2 nematic condensate. We also delineate the physical significance of the quasi-NG modes in the condensate.

References:

[1] S. Uchino, M. Kobayashi, and M. Ueda, Phys. Rev. A **81**, 063632 (2010).
[2] S. Uchino, M. Kobayashi, M. Nitta, and M. Ueda, Phys. Rev. Lett. **105**, 230406 (2010).