

低温物質科学研究センタ - セミナ - 報告

日時：2005年3月17日午後16:00～

場所：理学研究科5号館 物理学教室 439号室

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題目：Density Waves in Quasi-One-Dimensional Boson- 2-Component Fermion Mixture

要旨：The density-wave structures are studied in quasi-one-dimensional atomic gas mixture of one-component bosons and two-component fermions using the mean-field approximation [1]. Owing to the Peierls instability in the quasi-one-dimensional fermion system [2], the ground state of the system shows the fermion density wave and the periodic Bose-Einstein condensation induced by the boson-fermion interatomic interaction.

For the two-component fermions, two density waves appear in each component, and the phase difference between them distinguishes two types of ground states, the in-phase and the out-phase density-waves.

A self-consistent method in the mean-field approximation is presented to treat the density-wave states in boson-fermion mixture with two-component fermions. From the analysis of the effective potential and the interaction energies, the density-waves are shown to appear in the ground state, which are in-phase or out-phase depending on a simple magnitude relation between the effective boson-fermion interaction. It is also shown that the periodic Bose-Einstein condensate coexists with the in-phase density-wave of fermions, but, in the case of the out-phase one, only the uniform condensate appears.

[1] E. Nakano, and H. Yabu, cond-mat/0411686 (2004).

[2] T. Miyakawa, H. Yabu, and T. Suzuki, Phys. Rev. A 70, 013612 (2004); Physica B 329-333, 28 (2003).