

Density response of an interacting two-dimensional electron gas under a uniform static magnetic field and an intense laser field

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We report on our latest theoretical attempt to formulate the calculation of the dispersion relation of the longitudinal plasmon for the electrons under a static uniform magnetic field and an intense laser field. We apply the recently obtained canonical transformation for the second quantized electron field operator that describes the many-electron system under the static uniform magnetic field and the time-dependent electric field. The transformation maps the electron field operator to a new field operator that describes the same many-electron system without the time-dependent electric field [1][2]. The transformation can be applied to the retarded density-density response function. Since the retarded density-density response function for the second quantized electron field under a uniform static magnetic field without the electric field has been calculated, we can obtain the retarded density-density response function for the original many-electron system with the magnetic field and the electric field. Then we can use the self-consistent linear response approximation [3][4][5][6] to investigate the collective mode, i.e., the longitudinal plasmon.

References

- [1] M. Fujita, T. Toyoda, J.C. Cao, and C. Zhang, Phys. Rev. B **67**, 075105 (2003).
- [2] T. Toyoda, M. Fujita, H. Koizumi, C. Zhang, Phys. Rev. B **71**, 033313 (2005).
- [3] T. Toyoda, Physica A, **253**, 498 (1998).
- [4] T. Fukuda and T. Toyoda, Journal of the Korean Phys. Soc. **46**, 701 (2005).
- [5] T. Fukuda and T. Toyoda, Phys. Rev. B **70**, 205117 (2004).
- [6] T. Toyoda and F. Fukuda, Phys. Rev. B **71**, 205312 (2005).