Linewidth Broadening in Edge-magnetoplasmon Resonance of Helium Surface State Electrons

T. Arai[a], S. Yamanaka[b], H. Yayama[b], A. Sawada[a], and A. Fukuda[c]

[a]Research Center for Low Temperature and Materials Sciences, Kyoto University, Kyoto, Japan
[b]Department of Physics, Kyushu University, Fukuoka, Japan
[c]Department of Physics, Hyogo College of Medicine, Nishinomiya, Japan

Edge-magnetoplasmon (EMP) is an electron density wave, which occurs in bounded two-dimensional electron gas (2DEG) exposed in a perpendicular magnetic field. EMP propagates within a narrow strip near the edge, while density in the bulk is uniform. We employed EMP resonance technique to study magneto-transport properties of 2DEG where edge states play an important role. We measured EMP frequencies and line widths of 2DES on liquid helium surface under various lateral confinement potentials. The experimental results show that as the lateral confinement potential is reduced measured EMP line width takes minimum at a certain strength of confinement potential and broad signal was obtained on further potential reduction. This broadening behavior is absolutely unexpected from the exsisting theories of conventional EMP. We consider that it is an oscillation mode transition which is responsible for the line width broadening. The line width behavior in the strong confinement region is reasonably explained by conventional EMP, while the broad signals in the weak confinement region is not. We will show our precise experimental data and discuss the origin of the line broadenings.