Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

**Spin Interference Effect in a Square Loop Array including the Rashba and Dresselhaus Terms**[1] T. KOGA[2], H. OKUTANI, GSIST, Hokkaido University and [2]CREST, JST, Y. SEKINE, [3]NTT Basic Research Laboratories, NTT Corporation, J. NITTA[2,3], GSEng., Tohoku University — The effect of electron wave interference to the electric conductivity ($\sigma$), including the effect of spin degree of freedom, is investigated through nanolithographically defined square (and other) loop array structures fabricated on $In_{0.52}Al_{0.48}As/In_{0.53}Ga_{0.47}As/In_{0.52}Al_{0.48}As$ quantum wells (QW). In this experiment, we measure $\sigma$'s of QWs as a function of magnetic field $B$ ($\mathbf{B}\perp$QW plane). These samples had a gate electrode covering the entire loop array structures, where a gate voltage $V_g$ was applied between the metal gate electrode and the QW. We note that $V_g$ controls both the carrier density and the Rashba and Dresselhaus spin-orbit terms within the QWs. It turned out that the magnetoconductance $\sigma(B)$ oscillates as a function of $B$ with a period corresponding to $h/2e$, which is denoted as the AAS oscillation. We found that the amplitude of the AAS oscillation in this system also oscillated as a function of $V_g$, which is called as a "spin interference" effect. We investigated this effect, which is also in close relation to the "Aharonov-Casher" effect (electric control of the phase of the electronic wave function), in detail including both the Rashba and Dresselhaus spin-orbit terms quantitatively.

[1]T.K. acknowledges the Inamori Foundation and the Murata Science Foundation for financial support.

Takaaki Koga
Hokkaido University

Date submitted: 06 Dec 2005 Electronic form version 1.4