Quantized Berry phase for itinerating singlets in one-dimensional t-J mod ISAO MARUYAMA, YASUHIRO HATSUGAI, Dept. of Applied Physics, University of Tokyo — The quantized Berry phase as a local order parameter of gapped quantum liquids is proposed for characterization of a topological or quantum order in various models including strongly correlated electron systems[1]. We apply the scheme to calculate the quantized Berry phase in the $t - J$ model, where the Berry phase is quantized as trivial or non-trivial value, i.e., 0 or π, due to some anti-unitary symmetry. One-dimensional $t - J$ model with a few electrons gives a realization of itinerating singlets when the exchange energy J is large. Although the charge excitation is gapless, the spin gap is finite. Then we can calculate the Berry phase by treating low energy states as a degenerated multiplet. To use a local spin singlet as a order parameter, we define the Berry phase by a local spin twist. It is found that the Berry phase is quantized actually and becomes uniform and nontrivial when the number of electrons $N = 4n + 2$, with n being an integer [2].
[1] Y. Hatsugai, cond-mat/0603230 to appear in J. Phys. Soc. Jpn.
[2] I. M. and Y.Hatsugai. unpublished

Isao Maruyama
Dept. of Applied Physics, University of Tokyo

Date submitted: 19 Nov 2006   Electronic form version 1.4