

Abstract Submitted  
for the MAR10 Meeting of  
The American Physical Society

**Topological Quantum Computing with p-Wave Superfluid**<sup>1</sup> MIKIO NAKAHARA, TETSUO OHMI, Department of Physics, Kinki University — It is shown that Majorana fermions trapped in three p-wave superfluid vortices form a qubit in a topological quantum computing (TQC). Several similar ideas have already been proposed, in which a qubit operation is performed by braiding the world lines of these two or four Majorana fermions. Naturally the set of quantum gates thus obtained is a discrete subset of the relevant unitary group. We propose a new scheme, where three Majorana fermions form a qubit. We show that continuous qubit operations are made possible by braiding the Majorana fermions complemented with dynamical phase factors. Furthermore, it is possible to introduce entanglement between two such qubits by geometrical manipulation of some vortices involved.

<sup>1</sup>Work partially supported by Grant-in-Aid for Scientific Research (C) from JSPS (Grant No. 19540422).

Mikio Nakahara  
Department of Physics, Kinki University

Date submitted: 17 Nov 2009

Electronic form version 1.4