Name	**Seigo Tarucha**
Organization	**The University of Tokyo**
Division/Department	**Applied Physics Department**
Title	**Prof.**

Presentation Title

Project outline: Topological electronics

Abstract

"Topological electronics" is defined as electronics in which electrical control of geometrically protected quantum phenomena is the key element. In our cooperative project the concepts of (A) Spin-orbit interaction, (B) Topological insulators, and (C) Non-local generation of entanglement are explored to develop non-dissipative electronics and a breakthrough for solid-state quantum information technology. (A) is manifestation of combined relativistic and quantum mechanical effects on electrons in solid and (B) is a new quantum state arising from topological features of the quantum phase, and both can lead to non-dissipative electron transport. (C) indicates independent quantum operation of spatially separated entangled electron pairs, and its full control may enable non-local quantum control.

Our Japan-Germany team has the experience as well as the scientific ability to approach the topics of topological electronics in an integrated and complementary manner. In (A) electrical control of Berry phase and spin-orbit interaction is used to realize quantum operation of non-dissipative spintronics and quantum information devices. In (B) non-dissipative electron transport in topological insulators HgTe and InAs/GaSb is studied to explore the physics behind and possible applications. In (C) InAs quantum dots and graphene contacted to superconductors are used to generate Cooper pair electron splitting and quantum control of the electrons apart from each other. Each subject of the team cooperation is led by the relevant groups of the Japan-German team (Fig. 1).

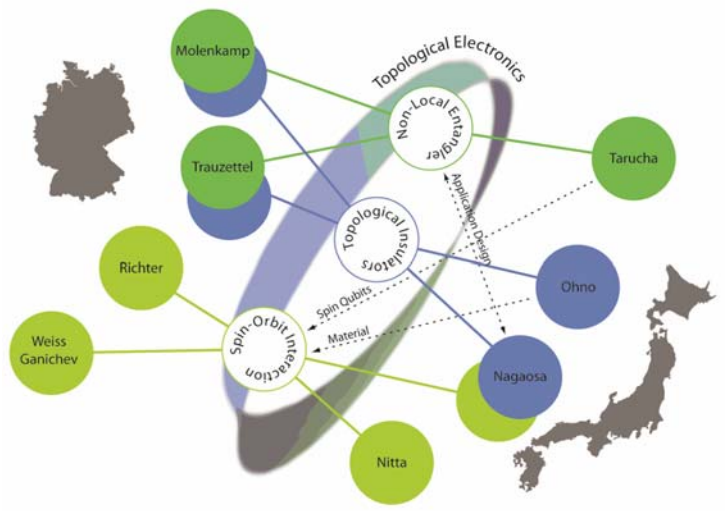

Fig.1 Team collaboration