Date: January 14, 2015

RIKEN Science Council
Research Personnel Committee
Chair Masahiko Iwasaki

External Reviewers
Hideo OHNO, Professor
Tohoku University
Susumu KOMIYAMA, Emeritus Professor
The University of Tokyo
Internal Reviewers
Yasunori YAMAZAKI, Chair
Hidetoshi KATORI
Tahei TAHARA
Franco NORI
Atsushi MIYAWAKI

Kimitoshi Kono, Chief Scientist
Low Temperature Physics Laboratory final review report

A review committee member composed of two external experts and five RIKEN internal experts gathered at RIKEN campus on December 25, 2014 for Dr. Kimitoshi Kono final review. The review results are reported as in the following.

総合的コメント(General comment public)

・研究目標の設定: Scientific objectives

Dr. Kono is an excellent scientist, with a very deep knowledge of low temperature physics, and has succeeded to construct a strong laboratory at RIKEN. His scientific style is very careful and systematic. He has focused on some long-standing and fundamental problems in low temperature physics. He carried out a variety of high-level fundamental researches with his principle of “carrying out a nearly impossible mission”, one of the best guidelines to expand the frontier of fundamental science. He kept his very original approach since he started his lab at RIKEN, which was quite successful and kept him as a world leader in his areas of research.

Dr. Kono has chosen three research directions: (1) the free surface of superfluid ^{3}He, (2) electron transport on He, and (3) semiconductor quantum dots. The goal of the first subject is to deepen the understanding of the physics of ^{3}He at temperatures lower than 1 mK. The objective of his second focus area is to combine low temperature physics with nanoscience, and the goal of the third is to elucidate the interaction between electron and nuclear spins in semiconductor nanostructures. These three directions are legitimate and the laboratory was established to carry out good science.

The second research area, electrons on the surface of liquid helium, is unique in the sense that an extremely low density of high-mobility two-dimensional electrons can be investigated. The subject is original and of basic scientific significance because two-dimensional electrons of largely different properties from those in semiconductors can be explored. Nevertheless, generating, maintaining and measuring those small numbers of electrons under well-defined conditions is experimentally difficult. He and his colleagues have developed articulate and careful experimental methods to explore a number of effects that would not have been otherwise disclosed.

His efforts to develop new probes for this research, such as microwave spectroscopy of surface-bound electrons and laser spectroscopy of Ba^+ in He, are highly evaluated.

・研究成果: Research Achievements

He successfully obtained top results in a variety of subjects such as semiconductor quantum dots, single electron transport on narrow channels with He, microwave-induced electron transport on liquid He, and the free surface of superfluid ^{3}He. Kono and his coworkers showed a number of beauties of low temperature physics.
The group has achieved numerous research achievements, published in very good journals. His publications are not highly cited because not too many other research groups are working in this field now. Still, it is noted that the quality of the research is excellent and world-class, which is remarkable and very positive.

Recent work on the free surface of superfluid ^{3}He revealed the right-left asymmetry

in the transverse current in the A-phase of ^{3}He, which is of particular interest and leading the field.

A variety of aspects of electrons on liquid helium surfaces, different from those in semiconductors, have been found. The scientific quality of the research is high. The analysis and the interpretation are accurate and sound, contributing to establish detailed understanding of the effects. In this area, the outcomes of Dr. Kono's lab are outstanding. Electron transport on He is very interesting as it combines nanoscience and electrons on He, which is believed to be one of the cleanest electron systems one can access, and reveals quasi-one dimensional properties of electrons on He as well as its intersubband physics.

The work on semiconductor nanostructures uncovered an interesting interplay between electron spins and nuclear spins, and it is extremely interesting work. Perhaps this research has not had a large impact so far, because it is very recent, but this research direction seems to be very promising and will eventually attract more attention from other groups.

・研究室の運営: Laboratory management

Dr. Kono has been managing the laboratory well. External funding has been very good as can be seen in receiving Grant-in-Aid for Specially Promoted Research for the second round, which allows his coworkers to carry out high-level fundamental researches. This would allow them to keep doing research also in the future. He has managed personnel well within the given history of the staff members joining his group.