平成 26 年 7 月 2 日

（独）理化学研究所
研究担当理事　川合 眞紀

平成 25 年度実施 准主任研究員の中間レビューの結果について

准主任研究員制度設置規定（平成 25 年規定第 14 号）に基づき准主任研究員の中間レビューを実施し、評価結果は以下のとおりです。

１．評価対象：柚木計算物性物理研究室. 柚木 清司 准主任研究員

１）評価体制

実施日：平成 26 年 3 月 20 日（木曜日）

4 名の所外有識者を評価委員とするヒアリングレビューを実施。

評価者：

Norio KAWAKAMI, Professor
Graduate School of Science,
Kyoto University, Japan

Masao OGATA, Professor
School of Science,
The University of Tokyo, Japan

Ichiro TERASAKI, Professor
Graduate School of Science,
Nagoya University, Japan

Matthias TROYER, Professor Dr.
Institut fur Theoretische Physik,
ETH Zürich, Switzerland

２）評価結果の概要等

General comments:　（arranged in random order）

【Reviewer 1】

The team of Associate Chief Scientist Dr. Seiji Yunoki works in the very active area of correlated electronic materials. His research spans the whole range of computational research in the field, from density functional theory based electronic structure calculations to simulations of model systems. Over the past five years the group has made important contributions to the field. One highlight has been the simulation and understanding of oxide heterostructures, and in particular exchange bias at antiferromagnetic perovskite interfaces and the understanding of 2D electron gases formed at $LaALO_3/SrTiO_3$ interfaces. Another high impact result were the extensive simulations on the K computer of the Hubbard model on a honeycomb lattice, which provided evidence for the absence of a spin liquid phase in this model. The question of spin liquids in this model has been heavily discussed in the community in recent years and the results of Seiji Yunoki and collaborators have been very important to answer

many open questions in this field.

In discussions with the group members I could see strong motivation and diverse skills by all group members, and good leadership skills of the group leader. New group members from abroad are welcomed and well integrated into the group. Dr. Yunoki advises his group members on a regular basis and with excellent results, as can be seen by the very good papers published by the group. While the group is excellently connected internationally, the group members could profit from closer interactions with other groups at RIKEN, in particular the theoretical group of Dr. Akira Furusaki and with experimental groups.

The future research plans of the group are timely and many interesting results can be expected. I expect that, just as the group's research has been diverse and broad in the past, the research projects will extend beyond the field of the iridates that have been highlighted in the research plans.

【Reviewer 2】

Yunoki's group has performed intensive researches in several interesting fields of strongly correlated quantum (electron or boson) systems. In particular, the numerical studies on the recent 5d Ir-related materials and the absence of spin liquid phase in the honeycomb lattice Hubbard model are very timely and will become very important works which remain as good references.

The group's organization seems to be very well. His group has a very good atmosphere among the postdocs for achieving high-quality studies and the communication between Dr. Yunoki and each postdoc as well as the communication among the postdocs seems to be smooth enough. I imagine that to organize his group coherently is a very hard task, but Yunoki has succeeded to manage and several good researches have been achieved in his group.

The future research plans of his group are interesting enough to be pursued in the following several years. In particular, the transition metal oxide hetero-structures will be one of the fruitful research fields since there are good experimental groups in RIKEN. It is a very good point that he is trying to collaborate with experimental groups. It is certain that this kind of tendency will lead to fruitful research activities.

To summarize, the activities of Yunoki's group is high enough as one of the theoretical groups in RIKEN. Overall assessment is very good. However, it seems to me that there are some more rooms for the extension of the research field, because Yunoki'g group contains very good postdocs. Furthermore, since his group has a very good access to the K computer in Kobe, it will be a good idea for the postdocs to use (rather intensively) the K computer in order to skill up their numerical activities.

【Reviewer 3】

The Associate Chief Scientist, Dr. Seiji Yunoki, has performed theoretical studies on correlated electron systems quite actively in these five years. The topics addressed by his group are interesting, which cover (a) oxide hetero-structures and magnetic junctions, (b) emergent quantum phases in strongly correlated quantum systems and (c) electron correlations and spin-orbit interaction. In all these topics, scientific

achievements are high and impressive. In particular, in theoretical studies on Iridium compounds (topic (c)) his group has clarified the important role of spin-orbit coupling in Mott transitions. Also, in the topic (b), his group has used the K-computer very efficiently in order to solve a controversial and challenging problem on the emergence/absence of a spin liquid phase in honeycomb-lattice correlated systems. Management of the group is organized quite well. In particular, I have an impression that young postdoctoral researchers are enjoying their research at Riken in collaboration with Dr. Yunoki. I think that these good conditions for young collaborators have lead to high research activities of Yunoki's group. They will certainly keep this activity in the future.

【Reviewer 4】

First of all, I highly appreciate his scientific achievements; They widely range from the interface of oxide electronic devices to recently emerging area of correlated iridium oxides. The core-competence of his carrier is based on the numerical calculations supported by deep understanding of theoretical physics. Using various computational techniques, he has succeeded in finding important results. Among them I appreciate the work onthe Hubbard model in a honeycomb lattice. He has shown not only that the spin liquid phase does not exist in a whole range of the parameters, but also that there is a novel Mott transition in this class. Since he did this work by making full use of K-Computer, it seems to me that he has successfully used full capability at the institute where he is.

For group management, I understand he kindly takes care of his group members, and let them work based on the skills they previously obtained. I feel he could encourage them to expand their expertise more, and he also could let them communicate with other researchers in different labs in RIKEN.

Currently he seems to focus on the physical properties of iridium oxides, which is a trendy area at present. Having said that, I wish I could hear from him what is next in this direction.

In summary, I think his scientific achievements exceed a certain criterion of highest quality, and his group management is also satisfactory.

以上