

## Engineering of Correlated Electron Matter

2 units (selection)

Yutaka Kishimoto · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING, Yu Kawasaki · ASSOCIATE PROFESSOR / MATERIAL AND DEVICE SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target**) In many solid-state materials, new phenomena evolve due to strong electron interactions. In this Lecture, review will be given on some advanced topics and their applications, including high temperature superconductivity, metal-insulator transition and strongly correlated electronics.

**Outline**) New types of superconducting and magnetic phenomena emerge in correlated electron matters. The term "correlated electron" represents the state of matter where many electrons are strongly interacting with each other. After an introductory talk on magnetism and superconductivity, review will be given on some advanced topics, including high temperature superconductivity, metal-insulator transition and colossalmagneto resistance. Potential application of correlated electron matters to technology is also presented focusing on spintronics or strongly correlated electronics.

**Style**) Lecture

**Keyword**) *strongly correlated electron systems, Mott insulator, colossalmagneto resistance, high temperature superconductor*

**Goal**) To understand basic concepts of correlated electron matter and its application

**Schedule**)

1. Introduction to correlated electron matters
2. Perspectives of magnetism and superconductivity in correlated electron matters
3. Electronic states of atoms and ions
4. Magnetic ions in crystal electric field
5. Introduction to superconductivity
6. How to probe rich properties in correlated electron matters
7. Mott insulator and metal-insulator transition
8. Spin, charge and orbital in transition metal oxides
9. Colossalmagneto resistance in transition metal oxides
10. Application of transition metal oxides with correlated electrons
11. High temperature superconductivity
12. Heavy-fermion superconductivity
13. Electronic states of organic conductors
14. Application of superconductors with correlated electrons
15. Towards strongly correlated electronics

**Evaluation Criteria**) Reports on several subjects in lecture

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216621>

**Contact**)

⇒ Kishimoto (A202, +81-88-656-7548, [yutaka@pm.tokushima-u.ac.jp](mailto:yutaka@pm.tokushima-u.ac.jp)) MAIL  
(Office Hour: 金曜日 16:00-17:30)

⇒ Kawasaki (A217, +81-88-656-9878, [yu@pm.tokushima-u.ac.jp](mailto:yu@pm.tokushima-u.ac.jp)) MAIL