

## Summary of my research activities

M. Katsuma

### Nuclear reactions

#### **Nuclear reaction theory Low-energy nuclear reaction relevant to astrophysics [2-5][10]**

- Theoretical  $^{12}\text{C}(\alpha,\gamma)^{16}\text{O}$  reaction rates are calculated.

#### **Nuclear rainbow phenomena [7,8,18,23]**

- Investigated the phenomenological potential for the  $\alpha + ^{12}\text{C}$  system
- Scrutinized the nuclear interaction potential between  $^{16}\text{O}$ - $^{16}\text{O}$  nuclei.
- Investigated molecular resonance for the  $^{16}\text{O}+^{16}\text{O}$  system at low energies, in the consistent description with the nuclear rainbow.

#### **Cluster structure, and Molecular resonances [1,11,19-21]**

- Predicted the  $8^+$  and  $9^-$  resonant states in the rotational bands of  $^{16}\text{O}$ .
- Tried to describe the molecular resonance for the  $^{16}\text{O}+^{16}\text{O}$  system, with microscopic coupled-channel method.

#### **Spin polarization [9]**

- Examined the possibility of the spin-orbit part of the microscopic folding model for  $^3\text{He}$ , and predicted the experimental results for spin-polarization.

### Nuclear data

#### **Reaction rates for astrophysics: NACRE (Brussels) [12-15]**

- Worked for an update and extension project of nuclear reaction rate library (NACRE), was in charge of the development of a code package evaluating low-energy nuclear reactions relevant to nuclear astrophysics.
- Proposed the re-consideration of the contribution from the direct mechanism using the direct capture potential model and distorted wave Born approximation (DWBA).

#### **Charged particle nuclear reactions: NRDF, EXFOR (Hokkaido Univ.) [6,16,17,22]**

- Developed a web application of a calculator of elastic scattering cross section.
- Tried to establish an evaluation method for mass fragmentation of the high-energy proton induced reactions in the development of the accelerator driven nuclear reactors.
- Engaged in the assistance of the construction and design of nuclear reactors with accelerator-driven transmutation system for the next generation.