

## A laboratory experiment of interstellar molecular reactions at RIKEN Cryogenic Electrostatic ring (RICE)

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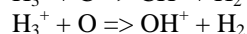
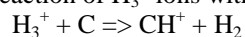
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A laboratory experiment of the interstellar molecular reactions is being developed at RIKEN cryogenic electrostatic ring (RICE). The RICE, shown in Figure 1, provides a novel opportunity to store atomic and molecular ion beams in a closed orbit under variable ambient temperatures (4-300 K). By injecting two different beams into the RICE at a low relative velocity to each other, the slow collision of interstellar molecules is reproduced in a cryogenic environment. The first cryogenic operation of the RICE was successfully performed in 2014 August, and a rotational laser spectroscopy of cold molecular ions is ongoing at 4 K.

Currently, an experimental setup for the neutral beam injection is under preparation. This aims to study the reaction of  $\text{H}_3^+$  ions with C and O atoms, namely,



as the starting point of the C-H and O-H series molecular evolution in space. The rate and branching ratio for each reaction path will be investigated as a function of the collision energy and environment temperatures.

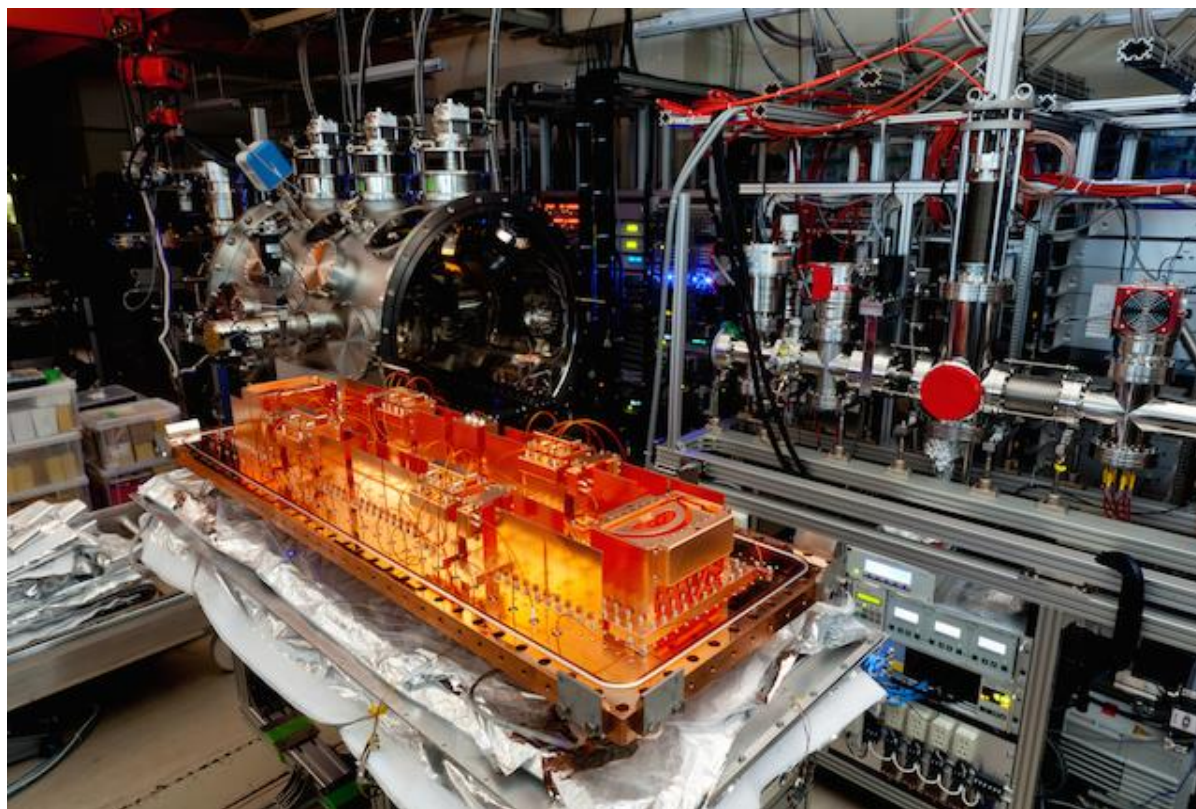


Figure 1: The photograph of the RIKEN Cryogenic Electrostatic ring (RICE); the copper-made electrostatic elements of the ring (center), the vacuum vessel with cryoheads (left), and the injection beamline (right).

### References

- [1] Y. Nakano, *et al.*, J. Phys. Conf. Ser. 388, 142027 (2012).