

**Impurity ions at the surface of superfluid He**P. Moroshkin<sup>1</sup>, R. Batulin<sup>1,2</sup>, D. Tayurskii<sup>1,2</sup>, P. Leiderer<sup>1,3</sup>, T. Arai<sup>4</sup>, K. Kono<sup>1</sup><sup>1</sup>*RIKEN CEMS, Wako, Saitama, Japan*<sup>2</sup>*Kazan Federal University, Kazan, Russia*<sup>3</sup>*University of Konstanz, Konstanz, Germany*<sup>4</sup>*Tohoku Institute of Technology, Sendai, Japan*

Positive impurity ions are considered to be a sensitive probe for a surface excitations of superfluid helium. In particular, they may be used in the search for the Majorana fermion surface states in <sup>3</sup>He-B [1]. Here we present the results of a preliminary laser spectroscopic study of Ba<sup>+</sup> ions in superfluid <sup>4</sup>He.

The ions are produced by the laser ablation and radio frequency discharge in He gas and are driven into superfluid He by a static electric field. We observe laser-induced fluorescence spectra of the ions solvated in superfluid He and compare them with the results of our calculations following the atomic bubble model. We also investigate laser ablation of Ba target in liquid He with subsequent laser sputtering of the primary ablation products in the electric field. The latter method produces mostly neutral Ba atoms and charged clusters.

We observe several types of static and dynamic perturbations of the charged superfluid He surface in the static electric field of 500-3000 V/cm. Our results suggest the existence of a potential barrier for a Ba<sup>+</sup> ion at the superfluid He surface and the instability of the charged He surface in the electric field that require further investigation.

1. Batulin *et al.*, J. Low Temp. Phys. **175**, 63 (2014)