RCNP EXPERIMENT

# PROPOSAL FOR EXPERIMENT AT RCNP

Jan. 28, 2000

TITLE : Study of Behavior of Impurities in Superfluid Helium


SPOKESPERSON : Tadashi Shimoda Associate Professor
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EXPERIMENTAL GROUP :

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|---|---|---|
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| H. Izumi | Dept. of Physics, Osaka University | Research Associate |
| T. Shigematsu | Dept. of Physics, Osaka University | Senior Research Fellow |
| N. Takahashi | Dept. of Physics, Osaka University | Professor |
| K. Horie | Dept. of Physics, Osaka University | D1 |
| Y. Hirayama | Dept. of Physics, Osaka University | M2 |
| M. Asai | Dept. of Physics, Osaka University | M1 |
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| M. Nakamura | Dept. of Physics, Osaka University | M1 |
| M. Yagi | Dept. of Physics, Osaka University | B4 |
| E. Sano | Dept. of Physics, Osaka University | B4 |


RUNNING TIME : Test running time for experiment 4.5 days
Data runs 7.5 days

BEAM LINE : EN course

BEAM REQUIREMENTS : 60 MeV/u $^{18}$O ($\geq$ 10 pnA)
70 MeV/u $^{22}$Ne ($\geq$ 1 pnA)

BUDGET : Experimental expenses 5,230 kYen

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## SUMMARY OF THE PROPOSAL

An impurity ion implanted into superfluid helium forms a micro-cluster of helium atoms around itself. The cluster referred to as "snowball" has been used for the investigation of the superfluid phase and its excitations. The structure of snowball has been discussed for many years and it is still one of the subjects of current topics. We have been extending the investigation by implanting radioactive nuclear beams into superfluid helium.

In the previous experiments in June and July, 1999 (E119), we have succeeded in observing separately the impurities of two categories, snowballs and neutralized atoms and we evaluated the formation probability of snowballs, which has been accessible so far in no other methods than ours. It seemed that the probability depends on the implanted beams. It would be related with the formation mechanism, although we have no explanation for this observation yet. Such dependence on core ion species, *i.e.,* the ionization potential and/or stopping power, or on other experimental conditions, is an interesting problem. We propose to measure the snowball formation probability under various conditions and with various nuclear species. The candidate radioactive nuclei are $^{9}$Li , $^{12}$Be , $^{13}$B , $^{15}$C , $^{12}$N , $^{19}$O and $^{20}$F