

The SCRIT Electron Scattering Facility at RIKEN RI Beam Factory

Tetsuya OHNISHI¹, Kousuke ADACHI², Akitomo ENOKIZONO¹, Takahiro FUJITA², Masahiro HARA¹, Mitsuki HORI², Toshitada HORI¹, Shin-ichi ICHIKAWA¹, Kazuyoshi KURITA², Toshimi SUDA³, Tadaaki TAMAE³, Kyo TSUKADA³, Mamoru TOGASAKI², Nobuaki UCHIDA², Masanori WAKASUGI¹, Masamitsu WATANABE¹, and Kouhei YAMADA²

¹*RIKEN Nishina Center for Accelerator-Based Science, Wako, Saitama 351-0198, Japan*

²*Department of Physics, Rikkyo University, Ikebukuro, Tokyo 171-8501, Japan*

³*Research Center for Electron-Photon Science, Tohoku University, 1-2-1 Mikamine, Sendai 982-0826, Japan*

E-mail: oonishi@ribf.riken.jp

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The SCRIT (Self-Confined Radioactive isotope Ion Target) electron scattering facility has been constructed at the RIKEN RI Beam Factory. In the commissioning experiment, the properties of the ion trapping were studied using stable ions. During the commissioning experiment, the first electron elastic scattering experiment of ^{132}Xe was performed and the charge density distribution was obtained. The achieved luminosity was $1.8 \times 10^{-27} \text{ cm}^{-2} \text{ s}^{-1}$ with a 250-mA electron beam current and the injection of 10^8 ions. The production of unstable nuclei has been started and developments for increasing rates of unstable nuclei are in progress. Electron scattering with unstable nuclei will be performed in the near future.

KEYWORDS: electron scattering, unstable nucleus, ion trapping

1. Introduction

In the study of nuclear structure, size and shape of nucleus are important fundamental properties. The charge density distribution, which directly reflects the proton distribution in nucleus, has been investigated using electron scattering with stable nuclei, from deuteron to uranium [1]. Because, electrons are structureless particles and there are no ambiguous interactions. Furthermore, electron scattering can probe the entire volume of nucleus without any serious disturbance [1].

Recently, the study of nuclear structure using short-lived unstable nuclei has been performed intensively owing to the progress of the RI production technique and devices [2]. Although many properties of unstable nuclei have been investigated using various reactions, the electron scattering has not been applied to short-lived unstable nuclei due to the difficulty of forming a target and realizing the required high luminosity.

The SCRIT (Self-Confined Radioactive isotope Ion Target) method [3] is a novel target-forming technique and it uses the ion-trapping phenomenon that is usually observed in an electron storage ring with residual gases. As a result of intensive developments, the practicality of the SCRIT method has already been demonstrated [4,5]. Then, the construction of the SCRIT electron scattering facility began at the RIKEN RI Beam Factory in 2009 and the commissioning experiment has been performed [6]. Concerning the RI production, a new online isotope separator (ISOL) system using the photofission of uranium was constructed and the RI production has been started since 2013 [7]. Recently, we completed the first electron elastic scattering experiment on ^{132}Xe and deduced the charge density distribution of this nucleus [8].