Kaonic-Atom X-ray Spectroscopy with Superconducting Microcalorimeters

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We will measure kaonic helium x-rays using transition-edge-sensor microcalorimeters, TES, in the J-PARC hadron experimental facility. To demonstrate the feasibility of the experiment, we performed a measurement of pionic carbon x-rays at PSI, where an excellent FWHM energy resolution of 7 eV at 6.4 keV was achieved. We also evaluated the expected TES performance in the kaon beam at J-PARC. The simulation results show that the TES spectrometer would work with a good energy resolution, and clear peaks of kaonic helium x-rays would be observed on a reasonably suppressed background.

KEYWORDS: $\bar{K}N$ interaction, kaonic atom, x-ray spectroscopy

1. Introduction

X-ray spectroscopies of hadronic atoms (e.g., $\pi^-, K^-, \bar{p}, \Sigma^-, \Xi^-$ atoms) provide unique information on the hadron-nucleon/nucleus interaction in the low-energy limits via their energy levels perturbed by the strong interaction [1]. The global tendency of available kaonic-atom data ranging from helium to uranium is well explained by the attractive and absorptive $\bar{K}N$ interaction. However, the real part strength of the potential differs widely among potential models. For example, a global fit with a phenomenological density-dependent potential yields $Re(V_0) \sim -180$ MeV [1], while a chirally mo-