

# The First Gamma-ray Spectroscopic Study of $sd$ -shell Hypernucleus, ${}^{19}_{\Lambda}\text{F}$

S.B. YANG<sup>1</sup>, Y. AKAZAWA<sup>2</sup>, K. AOKI<sup>3</sup>, N. CHIGA<sup>2</sup>, H. EKAWA<sup>4</sup>, A. FELICIELLO<sup>5</sup>,  
M. FUJITA<sup>2</sup>, S. HASEGAWA<sup>6</sup>, S. HAYAKAWA<sup>7</sup>, T. HAYAKAWA<sup>7</sup>, R. HONDA<sup>7</sup>,  
K. HOSOMI<sup>6</sup>, S.H. HWANG<sup>6</sup>, N. ICHIGE<sup>2</sup>, Y. ICHIKAWA<sup>6</sup>, M. IKEDA<sup>2</sup>, K. IMAI<sup>6</sup>,  
S. ISHIMOTO<sup>3</sup>, S. KANATSUKI<sup>4</sup>, S.H. KIM<sup>8</sup>, S. KINBARA<sup>9</sup>, K. KOBAYASHI<sup>7</sup>,  
T. KOIKE<sup>2</sup>, J.Y. LEE<sup>1</sup>, K. MIWA<sup>2</sup>, T.J. MOON<sup>1</sup>, T. NAGAE<sup>4</sup>, Y. NAKADA<sup>7</sup>,  
M. NAKAGAWA<sup>7</sup>, Y. OGURA<sup>2</sup>, A. SAKAGUCHI<sup>7</sup>, H. SAKO<sup>6</sup>, Y. SASAKI<sup>2</sup>, S. SATO<sup>6</sup>,  
K. SHIOTORI<sup>10</sup>, S. SUTO<sup>2</sup>, H. SUGIMURA<sup>6</sup>, S. SUZUKI<sup>3</sup>, T. TAKAHASHI<sup>3</sup>,  
H. TAMURA<sup>2</sup>, K. TANIDA<sup>6</sup>, Y. TOGAWA<sup>2</sup>, M. UKAI<sup>2</sup>, T.F. WANG<sup>11</sup>,  
and T.O. YAMAMOTO<sup>2</sup>

(The J-PARC E13 Collaboration)

<sup>1</sup>*Department of Physics and Astronomy, Seoul National University, Seoul 151-747, Korea*

<sup>2</sup>*Department of Physics, Tohoku University, Sendai 980-8578, Japan*

<sup>3</sup>*Institute of Particle and Nuclear Studies (IPNS), High Energy Accelerator Research Organization (KEK), Tsukuba, 305-0801, Japan*

<sup>4</sup>*Department of Physics, Kyoto University, Kyoto 606-8502, Japan*

<sup>5</sup>*INFN, Sezione di Torino, via P. Giuria 1, 10125 Torino, Italy*

<sup>6</sup>*Advanced Science Research Center (ASRC), Japan Atomic Agency (JAEA), Tokai, Ibaraki 319-1195, Japan*

<sup>7</sup>*Department of Physics, Osaka University, Toyonaka 560-0043, Japan*

<sup>8</sup>*Department of Physics, Korea University, Seoul 136-701, Korea*

<sup>9</sup>*Department of Education, Gifu University, Gifu 501-1193, Japan*

<sup>10</sup>*Research Center for Nuclear Physics (RCNP), Osaka University, Ibaraki, Osaka 567-0047, Japan*

<sup>11</sup>*Research Center of Nuclear Science and Technology (RCNST) and School of Physics and Nuclear Energy Engineering, Beihang University, Beijing 100191, China*

*E-mail: maruchi2@snu.ac.kr*

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The first  $\gamma$ -ray spectroscopy of  $sd$ -shell hypernucleus,  ${}^{19}_{\Lambda}\text{F}$ , is performed in June, 2015 at the J-PARC K1.8 beam line (J-PARC E13). Precise energy levels of  ${}^{19}_{\Lambda}\text{F}$  can be revealed by measured  $\gamma$  rays in this experiment. Especially, the strength of  $\Lambda N$  spin-spin interaction in  $sd$ -shell hypernucleus is obtained through the energy spacing of the ground-state doublet of the hypernucleus. By comparing its strength between the  $s$ ,  $p$ , and  $sd$ -shell hypernuclei, a radial dependence of  $\Lambda N$  interaction is investigated. The hypernucleus is produced through the  $(K^-, \pi^-)$  reaction with the beam momentum of 1.8 GeV/c. In very preliminary results, we observed two  $\gamma$  rays, and their energies are  $315.8 \pm 0.4$  keV and  $895.3 \pm 0.3$  keV where the uncertainties are only statistical.

**KEYWORDS:**  $sd$ -shell hypernucleus,  $\gamma$ -ray spectroscopy, J-PARC E13,  $\Lambda N$  interaction

## 1. Introduction

The  $\gamma$ -ray spectroscopic study of  $\Lambda$ -hypernuclei is a powerful tool to determine its energy levels precisely. An experimental technique to use Germanium (Ge) detectors with a high energy resolution is necessary to resolve energy splitting of non-zero spin states of a core-nucleus. Since 1998,  $\gamma$  rays