

# Reports from the Strangeness in Nuclear Physics (SNP) School and the Hadron and Nuclear Physics (HNP) Workshop

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## ABSTRACT

In December, 2017, an international school and workshop for hadron and nuclear physics were held in Tokai, Japan and in Wako, Japan, as endorsed by ANPhA, the nuclear physics division (DNP) of the Association of Asia Pacific Physical Societies (AAPPS). The school and the workshop are international events that have attracted many young Asian physicists on a yearly or biannual basis. We hope that these events will continue to be regular activities, driven by Asian countries to encourage and promote young physicists.

## INTRODUCTION

Recently, there have been many opportunities to meet and present research achievements in various conferences and workshops. However, the events reported here are unique in that the events were intended to provide a distinct opportunity for young physicists. This idea matches precisely the aim of the funding agencies, which includes the Asia Pacific Center for Theoretical Physics (APCTP<sup>1</sup>), the Research Center for Nuclear Physics of Osaka University (RCNP), and J-PARC (Japan Proton Accelerator Research Complex) [1,2]. The strangeness in nuclear physics (SNP) school was held from December 14 - 16,

### SNP School



J-PARC tour

### Awards



### Posters



### HNP Workshop



<sup>1</sup> APCTP supported this program as one of the category-4 activities.

and the hadron and nuclear physics (HNP) workshop from December 18 - 22. In fact, there was also another workshop, REIMEI, held at JAEA, Tokai, from December 11 - 12. Therefore, two weeks, from Dec. 11 – 22, were used exclusively for the meetings in the Kanto area of Japan, for hadron and nuclear physics. Up to now, the SNP and HNP events had been organized independently, but this time we tried to merge them through the strong support from APCTP. Consequently, the two events were successfully held with more participants than we expected based on attendance from previous years. As the data summarized in Table 1 and 2 shows, there were many young participants from various countries around Asia.

**SNP SCHOOL**

The school on strangeness in nuclear physics (SNP) is the series of an international school which started in 2012, at J-PARC and Tohoku University in Japan. The subjects of the school have been those of hypernuclear physics and related topics in hadron-nuclear physics.

**Table 1:**Country of affiliation of the participants.

Countries	SNP	HNP	Both	Total
China	7	27	6	34
Germany	4	4	2	8
India	2	2	2	4
Indonesia	1	1	1	2
Japan	33	42	9	75
Kazakhstan	1	1	0	2
Malaysia	1	0	0	1
Korea	3	12	3	15
Russia	2	2	2	4
Spain	0	1	0	1
Switzerland	1	1	1	2
Thailand	3	5	3	8
Turkey	0	1	0	1
Uzbekistan	1	1	1	2
Vietnam	1	1	1	2
USA	2	0	0	2
<b>Total</b>	<b>62</b>	<b>101</b>	<b>31</b>	<b>163</b>

**Table 2:**Number of young participants.

Young Prticipants	SNP	HNP	Both	Total
Students	34	26		60
Postdocs	2	15	2	17
<b>Total</b>	<b>36</b>	<b>41</b>	<b>13</b>	<b>77</b>

Hypernuclei are atomic nuclei containing strange quarks, which are the third flavor of quarks following the up and down quarks. It does not appear in ordinary matter but does show up in extremely dense matter, or it can be artificially produced with particle accelerators on the earth. The physics of hypernuclei is involved with many important issues of modern physics, such as high precision baryon interactions that are studied experimentally by accelerators and theoretically by high performance supercomputers, which is the latest subject of quantum chromodynamics (QCD) for their strong interactions. Recently, the physics of hypernuclei also is in strong contact with hadron physics of exotic natures with heavy quarks, such as charm and bottom quarks, and with few-body physics in relation to universal physics, which has been recently actively developed in the field of cold atoms.

Given the scope of this field, this time we invited five lecturers, K. Hicks (Ohio, Experimental studies of hadron structures), T. Hyodo (Kyoto, Lambda(1405) and KN interaction), C. Green (Purdue-Madison, Cold atoms), T. Saito (GSI, Hypernuclear physics with heavy ion beams), and B. Balantekin (Wisconsin-Madison, Particle physics and astrophysics). We had also a facility tour to J-PARC, and a young scientist session. Excellent presentations were then awarded prizes, Hashimoto/ANPhA-DNP 1st and SNP incentive/ANPhA-DNP 2nd prizes.

**HNP WORKSHOP**

The workshop on hadron and nuclear physics (HNP) originally started as a collaboration meeting between RCNP, Osaka Univ. and Pusan National Univ, and has continued as a medium size workshop between Korea and Japan. In 2009, in the workshop held in Kizu, Japan, we expanded the scale of the workshop in order to invite more participants from Asian countries. The number of participants has been typically 50 to 100 at maximum, but this time we had around 100 participants. The philosophy of this workshop was to encourage young people to participate and discuss readily. The latest topics were also arranged as presented by the leading researchers. Observing similar ideas and methods in hadron physics and nuclear physics, all contributions were allotted time as oral nested in a flexible manner in plenary sessions as much as possible. In this way, participants could communicate on the latest status of the relevant research fields.

This time, while combined with the SNP school, topics related to strangeness hadron nuclear physics, exotic

hadrons, nuclear structure with multi-nucleon correlations and recent progress in cold atoms were particularly discussed. In addition, as an important development in physics in 2017, we invited several speakers for a gravitational wave session and its relevance to astrophysics and hadron-nuclear physics.

## SUMMARY

The combined organization of the SNP school and HNP workshop was quite successful, and had an impact on the young participants. Research activities like this are

important in encouraging and developing scientific achievement in Asian countries, and we wish to continue these events through the support of AAPPS and its related organizations.

## References

- [1] Web site of SNP school;  
<http://www.rcnp.osaka-u.ac.jp/~snp2017/index.html>
- [2] Web site of HNP workshop;  
<https://indico2.riken.jp/indico/conferenceDisplay.py?confId=2540>



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