

京都大学若手人材海外派遣事業 スーパージョン万プログラム
研究者派遣プログラム

英文報告書

提出日：平成26年 9月 9日

1. 渡航者 (日本語)			
氏名	藤岡 宏之	採択年度	平成25年度
部局	理学研究科	電話	
職名	助教	メール	
研究課題名	大強度陽子ビームを用いた η' 中間子の媒質効果の測定 Measurement of in-medium properties of η' mesons with high-intensity proton beam		
海外渡航期間	平成26年 3月31日～平成26年 5月 3日 平成26年 6月23日～平成26年 8月15日		
渡航先 (英語表記)	国名： Federal Republic of Germany 大学等研究機関名： GSI Helmholtzzentrum für Schwerionenforschung GmbH 研究室名等： Super-FRS Group 受入研究者名： Prof. Dr. Dr. h. c. Hans Geissel		
2. 渡航の報告 (英文)			
<p>渡航先の研究環境、研究者との交流、研究発表の状況等、渡航中の滞在経験について英語(500～1000語)で記述して下さい。受入研究者と撮影した写真や研究発表で用いた図等について、可能な範囲で別添として提出して下さい。ページ数については増加してもかまいません。</p> <p>The properties of an η' meson, such as its mass, are expected to change at finite density. One of the possible ways to investigate the in-medium property is to produce a nucleus in which the meson is embedded. In order to produce such a bound state, we propose to make use of an intense proton beam supplied from the SIS-18 synchrotron at GSI Helmholtzzentrum für Schwerionenforschung GmbH. I serve as the co-spokesperson of the experimental program, and have been working mainly on a detailed simulation and the R&D of detectors to be used for the tracking of scattered particles and for the particle identification since 2011.</p> <p>The beamtime for this measurement was allocated from 1st until 8th August 2014. I began to stay at GSI from the end of March, not only for the on-site preparation, but also for a series of preliminary measurements with nickel-58 and proton beams in April. The ion-optics of the FRS spectrometer optimized for our measurement was measured precisely, and a kind of rehearsal with the same condition, except for a thinner target and a lower intensity proton beam, was very meaningful in that the background level was found to be almost the same as that evaluated by a simulation.</p> <p>In addition, I joined another experiment with a similar condition at the same place, which lasted for one week preceding our beamtime. The aim of the experiment was to investigate the role of the tensor force in a nucleus by using a large momentum transfer reaction. The tensor force is one of the most important concepts in nuclear physics. While I have been working in the field of hadron physics, it was the first time to participate an experiment categorized as nuclear physics.</p> <p>Since the beam was delivered to our experimental site almost continuously for days and nights, approximately</p>			

30 persons took shifts for 8 hours each. They came from Germany, Japan, Canada, China, Slovakia, Spain, and Sweden. The important tasks during a shift are to check raw data from each detector, to analyze data, which would provide criteria for the measurement within the rest of the beamtime, to move in and out the target, and to change the beam energy and the ion-optics of the spectrometer for the preparation of a different kind of measurement. The operation of the FRS spectrometer at the console was rather complicated and difficult for me (partially because the description is written mainly in German), but I could manage to execute basic operations after instructions by experts. I led the midnight shifts as the shift leader, and stayed at the hut (named "Messhütte") a few hours before and after the shift, in order to get a better understanding of the situation of the on-going experiment and discuss the progress of the analysis and the strategy with colleagues.

Another purpose of this visit is to deepen the future plan of the experiment. At a new facility of FAIR (Facility for Antiproton and Ion Research) which is under construction next to GSI, an improved spectrometer Super-FRS will enable us to carry out a coincidence measurement for η' meson-nucleus bound states. Based on the knowledge obtained in the beamtime, I have started more quantitative evaluation of the feasibility. I explained the achievement to Prof. Dr. Hans Geissel, the hosting researcher, before leaving GSI. He kindly encouraged me to proceed with the upgraded experimental program within the framework of the Super-FRS collaboration.

Through the long-term stay supported by the Super John Mung program, I could communicate with a number of researchers and gain a lot of experiences at one of the most famous facilities in the field of nuclear physics. I would like to continue research related to hadron physics, especially on the in-medium meson properties, at world-famous facilities such as J-PARC in Japan, GSI and FAIR in Germany.

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