

(For JSPS Fellow)

Form B-5

Date (日付)

31/08/2016 (Date/Month/Year: 日/月/年)**Activity Report -Science Dialogue Program-**

(サイエンス・ダイアログ事業 実施報告書)

- Fellow's name (講師氏名): CHITRA SHUKLA (ID No. P15015)- Participating school (学校名): Fukushima Prefectural Fukushima High School, Japan- Date (実施日時): 23/08/2016 (Date/Month/Year: 日/月/年)- Lecture title (講演題目): (in English) Quantum Communication & Cryptography(in Japanese)

- Lecture summary (講演概要): Please summary your lecture 200-500 words.

In the beginning of the lecture, the meaning of the lecture-title was explained about "What is Quantum?", "What is Communication?" and "What is Cyptography" so that the students could follow what they are going to listen about. Then, I introduced myself along with some very important questions I have been asked to briefly explain the students; such as (i) My motive for becoming a scientist? (ii) What do I find interesting about my research? I answered these questions to motivate them for studying Science. Then the introduction of Indian National symbols with the importance of its old culture and civilization are presented and the discussion followed by some great Indian personalities and the great Scientists for their valuable contributions at the National and International levels in their respective areas of Social and Sciences (Physics, Chemistry and Mathematics). Since, the lecture was all about quantum communication and cryptography, which requires some very basic knowledge of the subject "Quantum Mechanics", hence, a brief history about the beginning of Quantum Mechanics have been told based on that some basic principles were introduced such as "Superposition". Interestingly, the concept of light-quantum was explained to shed light on the quantum mechanical resources such as qubits, quantum gates and entangled states, etc. In the rest of the lecture, quantum teleportation were explained together with the idea of unconditional security of quantum key distribution (QKD) with the suitable examples through the pictures and animations to let the students have the clear idea of how quantum world is advantageous over the classical world. Subsequently, some existing models of Quantum Computer are also shown with their pictures such that, D wave two, Quantum Experience (5-qubit quantum computer). Some useful youtube links are also provided in the slides at appropriate places for their further interest. The whole lecture was prepared in such a way, that basic lesson behind the lecture to let the students understood the key point that RSA based technology for secure communication they use everyday is based on mathematical assumptions and is not unconditionally secure. However, the existence of quantum algorithm proposed by P. Shor, has threatened RSA cryptography, and above all Quantum Key Distribution

(QKD) for unconditional security has been proposed by Bennett and Brassard in 1984 known as BB84, and several International companies including some Japanese companies like Toshiba and Mitsubishi Electric etc. sell their product of QKD and QKD smart phones respectively for unconditionally secure communication between two parties. It was evident from student's presentation on my lecture that they really got the basic lesson about the above key points. Finally, the lecture was ended with two cartoon pictures: 1. To justify the students that why should they listen this talk even if they do not work in quantum communication, and 2. To give the students a glimpse that if a scalable quantum computer is built then they may have an unconditionally secure quantum bank and people would be leaving the RSA based classical bank because its no more secure.

- Language used (使用言語): English and explained in Japanese by accompanying person

- Lecture format (講演形式): pptx

◆Lecture time (講演時間) 60 min (分), Q&A time (質疑応答時間) 10 min (分)

Student's presentation time about my lecture 50 min (分)

◆Lecture style (ex.: used projector, conducted experiments)

(講演方法 (例: プロジェクター使用による講演、実験・実習の有無など))

Projector is used

◆Interpretation (ex.: assistance by accompanied person, provided Japanese explanation by yourself) (通訳 (例: 同行者によるサポート、講師本人による日本語説明))

The accompanied researcher Mr. Inoue has explained the lecture in Japanese

◆Name and title of accompanied person (同行者 職・氏名)

Mr. Yuki Inoue, Ph.D. Student (II Year)

◆Other note worthy information (その他特筆すべき事項):

I must say, that the schedule organized by Fukushima High School teachers; Mr. Kanazawa and others, was very impressive, because after my lecture (60 mins), they have provided a specific section of 15 mins for group discussion to the students about the lecture and further to let them present (50 mins) their views and understanding about the lecture in the groups of 4-5 students. That was an amazing experience about their understanding of lecture. The students were really very good in communication, the way they presented my lecture I was impressed. I appreciate their enthusiasm and endeavor very much. Their understanding about the lecture and technology was exceptionally higher than my imagination or expectation. To be very honest, this was my first time to give a lecture to the students who do not study Physics, but my experience was really wonderful with them and I always have a great memory of the time I spent with them. I believe that some of them will enter some day in this field of Science and Technology, encouraged by JSPS Science Dialogue Program. I really appreciate and recommend this kind of schedule as set by Fukushima High School to establish the mutual understanding between the students and JSPS fellows.

- Impressions and opinions from accompanied person (同行者の方から、本事業に対する意見・感想等がありましたら、お願いいたします。):

バックグラウンドの異なる若い方々と研究について話題を共有できて、大変有意義でした。  
もう少し高校生と議論をしたりするなどして、共有したことに対してお互いの理解を深められたら  
より有意義になると思います。  
ありがとうございました。