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（For JSPS Fellow）

Form B-5

Date（日付） 05/08/2013
（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）: Jinguang Cheng （ID No. P12023 ）

- Participating school（学校名）: Aichi Prefectural Jishukan High School

- Date （実施日時）: 02/08/2013 （Date/Month/Year:日/月/年）

- Lecture title（講演題目）: （in English）High Pressure Induced Phase Transitions

（in Japanese） 圧力誘起される相転移

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

Pressure (P) and temperature (T) are two fundamental thermodynamic parameters that determine the stable state of all substances. By varying P and/or T, these states can change from one to another, which is termed *phase transition*. The temperature-induced transformations of water to ice at $T < 0°C$ and to vapor at $T > 100°C$ at ambient pressure are most familiar examples of phase transition. In this lecture, however, I focused on the pressure-induced phase transitions of solid materials, which opens up a broad dimension for discovering new states of matters. I began with a brief introduction to pressure, including the definition and the common units of pressure. In order to have a feeling about high pressure, I listed some typical values of pressure surrounding us. Then, I described several high-pressure techniques and apparatus, such as the piston-cylinder, multianvil, and diamond anvil cells, which can be used to generate high pressures up to hundreds gigapascal (GPa), where $1\ GPa = 10^9\ Pa \approx 10^4$ atmospheric pressure. By using a diamond-anvil-cell-type apparatus, we performed a demonstration experiment that shows how the water transforms into ice at room temperature by applying high pressure. Based on the above knowledge about high pressure, I went further to introduce two aspects of our current research. (1) Pressure-induced structural transition in the ABO_3 oxides. As the principal constituent of the earth's lower mantle, ABO_3 perovskite is a stable structure under high-pressure and high-temperature conditions. I took the $BaRuO_3$ as an example to illustrate how the perovskite structure is stabilized gradually under high pressure. (2) Pressure-induced electronic-state transition. Here, the electronic state refers to the capability of electrical conduction for a given material, which can be generally classified into insulator, metal, and superconductor, corresponding to a poor, good, and super electrical conduction, respectively. I took an organic Mott insulator β'-(BEDT-TTF)$_2$ICl$_2$ as an example to illustrate the progressive electronic-state transitions under high pressure.

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- Language used（使用言語）: English
- Lecture format（講演形式）:
  - ◆Lecture time（講演時間） 80 min（分）, Q&A time（質疑応答時間） 40 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））
    Used projector and conducted experiments
  - ◆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））
    Demonstration experiments assited by the accompanied person
  - ◆Name and title of accompanied person（同行者 職・氏名）
    Dr. Kazuyuki Matsubayashi
  - ◆Other note worthy information（その他特筆すべき事項）:

- 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。）:

今回の派遣先は講師らにとっては遠方の愛知県であったが、滞りなく事業を実施することができた。高校生にとっては少し難しい内容もあったかとは思われるが、講演者のプレゼンテーション技術と丁寧な説明、さらにデモ実験を組み合わせたことで、固体物理における相転移現象を身近のものとして体験してもらえたのではないかと思う。ただし、(英語での)議論をすることに不慣れな高校生であることを考慮すると、もし可能であればさらに少人数(20 名以下)での実施形態をとった方が、より活発な議論ができるという印象を受けた。