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Institute: JAXA ISAS
Division: Solar System Science
Host researcher: Yoshifumi Saito

The theme of my project was researching methods to combine low energy electron spectrometers and low energy ion spectrometers into a single (two-in-one) instrument for measuring space plasmas. The main concept to enable this is having incoming ions converted into electrons and then just detecting electrons. To achieve this, incoming ions (and optionally incoming electrons also) should impact a secondary electron emitting material, and thus release secondary electrons which can be detected by a positively biased (electron-detecting) MCP.

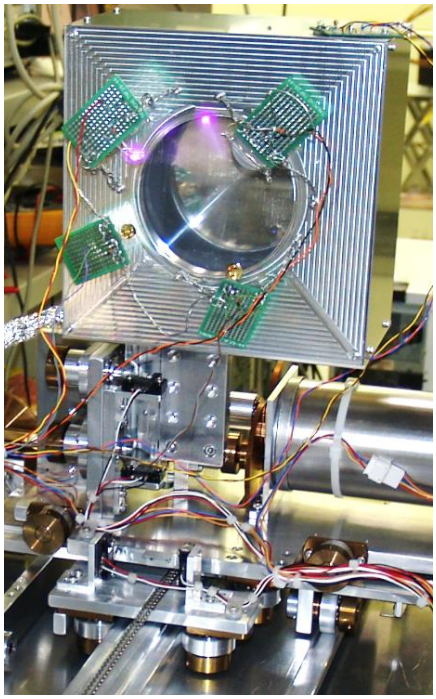

Figure 1- UV LED stimulated low energy electron source

To be able to test such an instrument a source of ions and a source of electrons was required. While suitable ion sources are commercially available (and available at ISAS), a suitable low energy electron source was not. So my first task was to build one of those (see Figure 1)

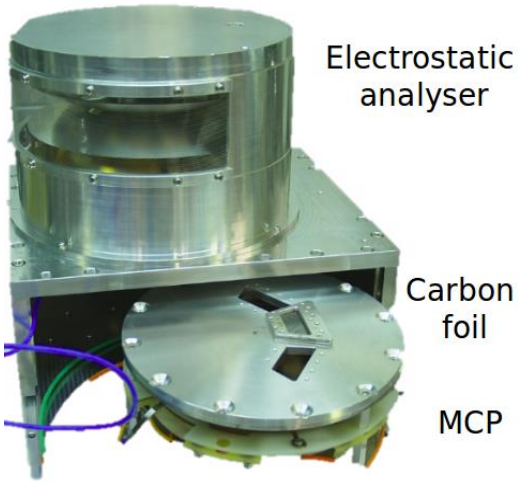

Figure 2- carbon foil based two-in-one analyser

With that built and tested I was able to develop and test the two-in-one concepts, the first of these being shown in Figure 2. For this I inserted a plate holding ultra-thin carbon foils between the electrostatic analyser and MCP detector of an existing space ion analyser design. I was able to demonstrate that electrons could pass through the foils while ions would create showers of secondary electrons at the foils, so that if the MCP were configured to detect electrons then the instrument could be used for both electrons and ions.

In a second experiment I built and tested various dynode materials placed between another analyser and MCP. The dynode converted both electrons and ions into secondary electrons While this work was originally targeted at the now cancelled SCOPE mission, through presentations at conferences it caught the eye of the Korean space agency as of possible relevance to their missions. Consequently research into this method is being continued by Yoshifumi Saito, who is preparing an instrument based on the carbon foil design for an upcoming sounding rocket mission.

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Tips

- Performing a hardware building project like this requires a patient colleague to help you discuss details with manufacturers. It is also challenging to get good results within the 2 year timeframe.
- Participate in the JSPS Science Dialogue programme giving outreach talks in simple English at schools around the country (Figure 3).
- Take responsibility for learning Japanese yourself but seek out free volunteer language classes for practice.
- Use Anki to aid language memorisation.
- Don't be scared of kanji, methods like the Heisig method are very effective for learning them.
- Try to get involved with the local community- I helped as a scout leader in a local group. Communication was challenging but it was great fun and I was made very welcome.
- Watch out for the fluctuating value of the yen.

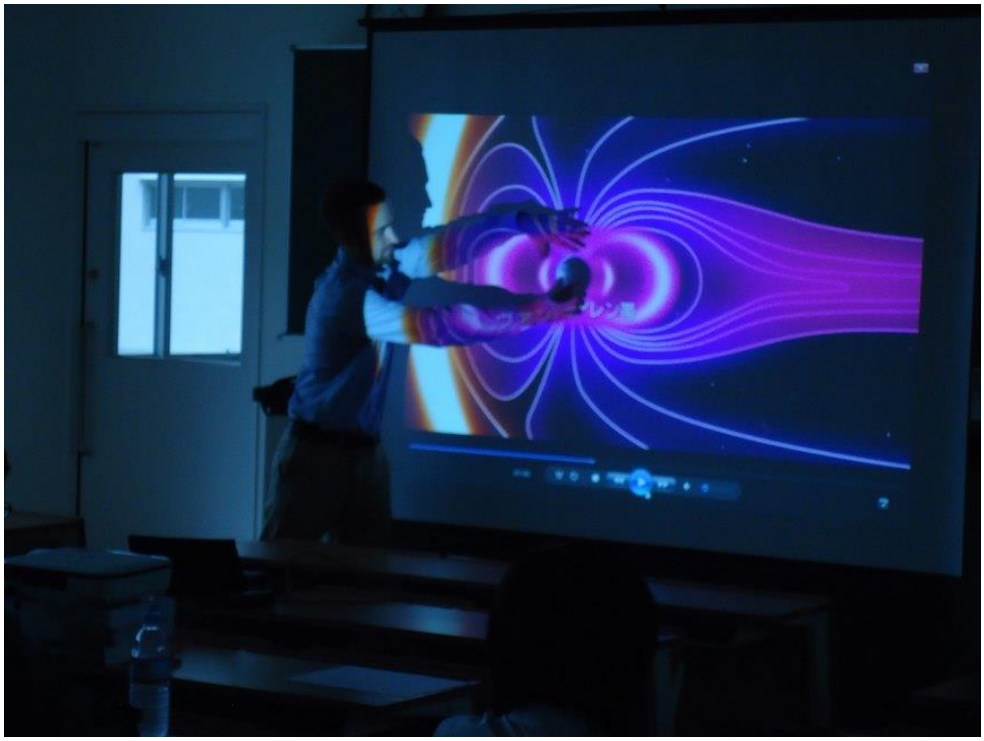

Figure 3-presenting at a JSPS Science Dialogue talk