

# SAIP2014



Contribution ID : 120

## **Automation, characterisation and application of a spectrometer for UV and Vacuum UV**

Wednesday 09 Jul 2014 at 17:10 (01h50')

### **Abstract :**

This project was aimed at firstly developing a computer control system for automation of a scanning monochromator (McPherson model 218). Secondly, the monochromator was characterised through use of an ultra violet (VU) light source. Lastly, the monochromator was applied to characterise the vacuum ultraviolet (VUV) laser source (142.40 nm to 146.73 nm). For the computer control system, a program was developed in order to control a stepper motor driver with acquisition functions (Uragan- $\mu$  developed by Synertronic) which was customized to control both the stepper motor that rotates the grating and to acquire data from a photomultiplier tube. Some of the key features of the program are mechanisms to eliminate the mechanical backlash of the system, to automatically save data after readings and to incorporate additional safety limitations which are independent of the mechanical safety switches. Characterisation using the mercury lamp demonstrated that the spectra were accurately reproducible when using the computer control system and that the monochromator has a spectral resolution of 0.5 nm with an entrance slit of 0.35 mm and an exit slit of 0.15 mm. The spectral resolution is expected to change when applying the monochromator to the VUV source as the slit size for this system can be set narrower due to the higher intensity yielding a higher-resolution. The monochromator was applied to investigate the generation of VUV light by third harmonic and sum frequency generation in a phase matched non-linear medium consisting of magnesium-vapour and krypton gas. The sum frequency VUV is used as a tunable VUV source in our laboratory. The third harmonic light is an unwanted byproduct. For the first time in our laboratory it is possible to measure the sum frequency and the third harmonic power separately and to optimise the sum frequency power independently from the third harmonic signal by using a monochromator. The monochromator will be used to investigate the phase matching conditions for VUV generation and to observe how the VUV power varies with experimental conditions.

### **Award :**

Yes

### **Level :**

Hons

### **Supervisor :**

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### **Paper :**

No

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**Session classification :** Poster2

**Track classification :** Track C - Photonics

**Type :** Poster Presentation