LASER-PRODUCED PLASMA SPECTROSCOPY OF MEDIUM TO HIGH-Z ELEMENTS IN THE 2 TO 9 NM SPECTRAL REGION

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1. Introduction

- The purpose of this experiment is the investigation of plasmas as sources of radiation in the 2 nm to 9 nm region.
- The "Water Window" region of the spectrum (2.3 to 4.4 nm) is of interest to those in the biomedical sciences due to its potential for high-contrast imaging of living tissue in an aqueous environment based on the strong absorption by carbon and the low absorption by oxygen [1].
- Mirrors such as Cr/Sc multilayer mirrors are available in the "water window" region [2].
- The 6.X-nm region is of interest to those in the semiconductor industry as a potential source for beyond extreme ultraviolet (BEUV) lithography [3] due to the development of boron-based multilayer mirrors [4,5].

2. Experimental Set-up

Specifications of Nd:YAG laser used to create plasmas:

• Pulse Duration	8 ns
• Energy	600 mJ
• Wavelength	1064 nm

Specifications of the grazing-incidence spectrometer used:

• Focal Length	0.25 m
• Spectral Range	1 to 20 nm
• Grating Used	2400 grooves/mm
• TE cooled CCD Camera	2048 x 2048 pixels

The experiment was set up as shown in Figure 1 and a schematic diagram of the spectrometer is shown in Figure 2.

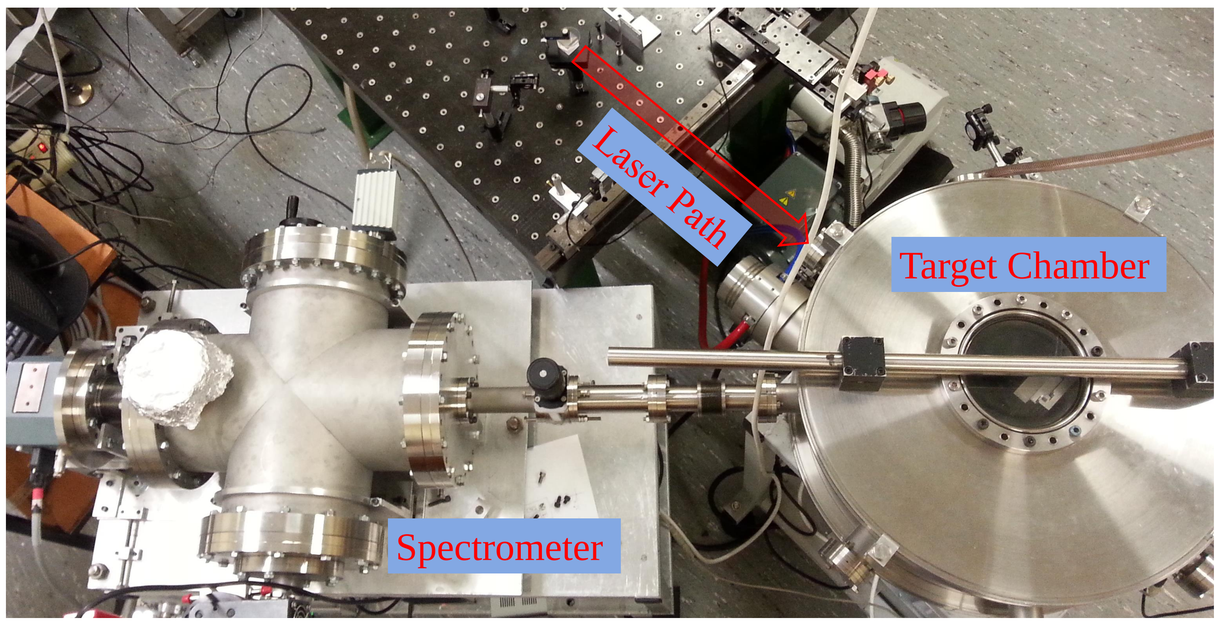

Figure 1: *Experimental set-up*

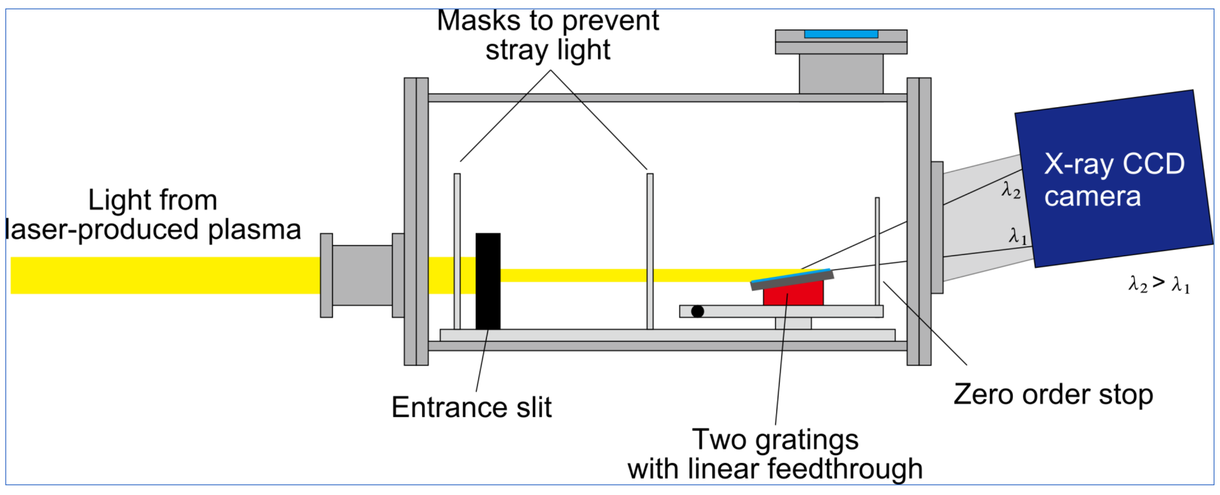

Figure 2: *Schematic diagram of spectrometer (courtesy of Takamitsu Otsuka)*

3. Results

The spectral results in the 2 to 9 nm region obtained for 16 medium to high-Z elements are shown in Figure 3.

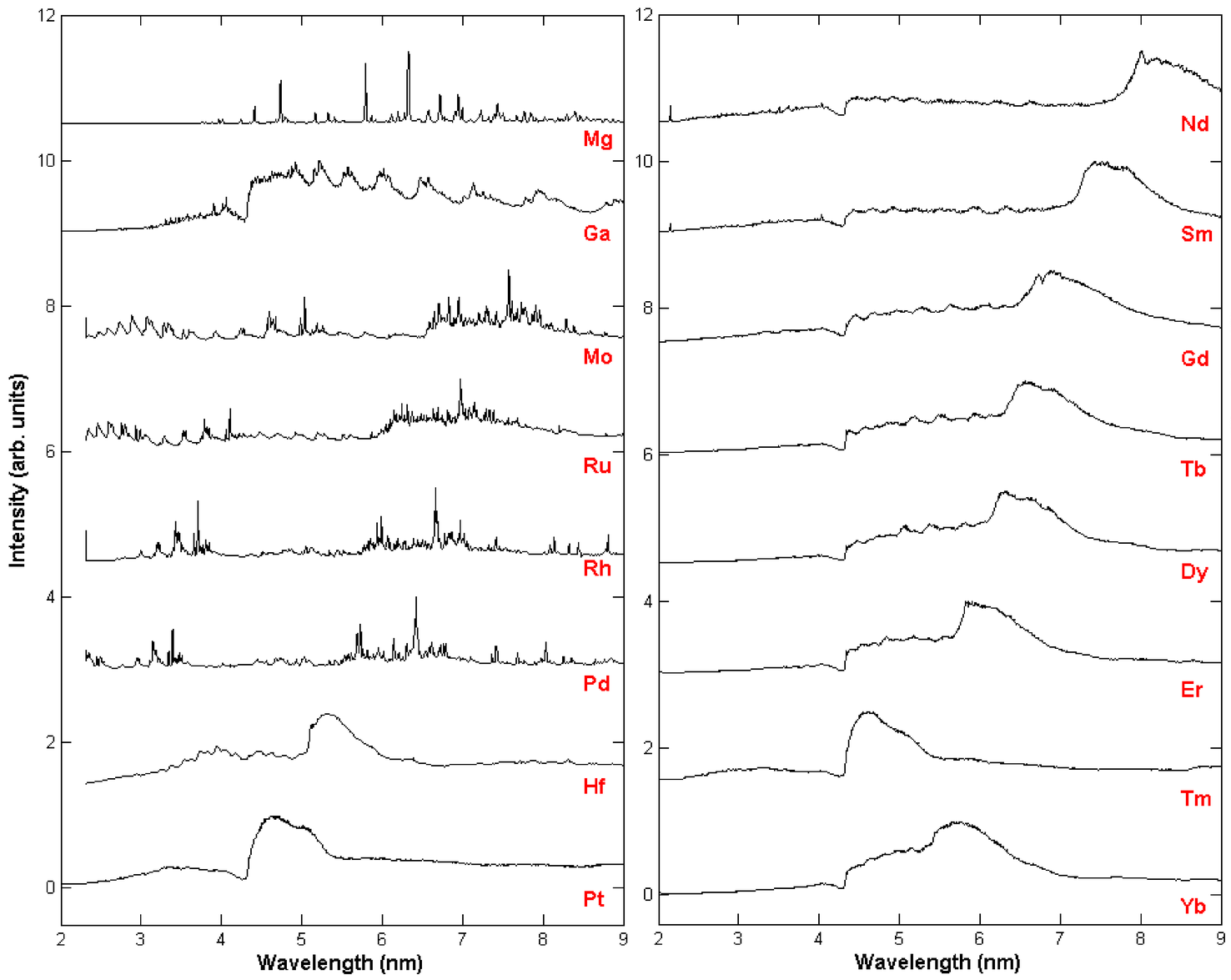

Figure 3: *Spectra of 16 Medium to High-Z Elements*

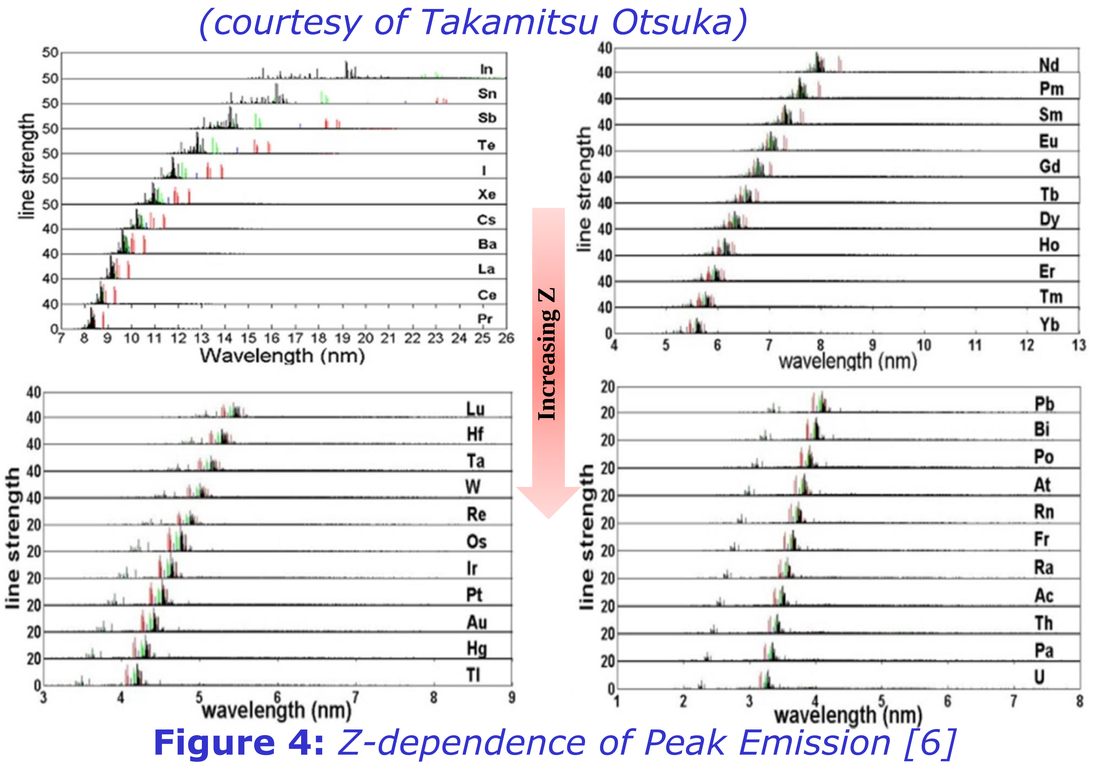

Figure 4: *Z-dependence of Peak Emission [6]*

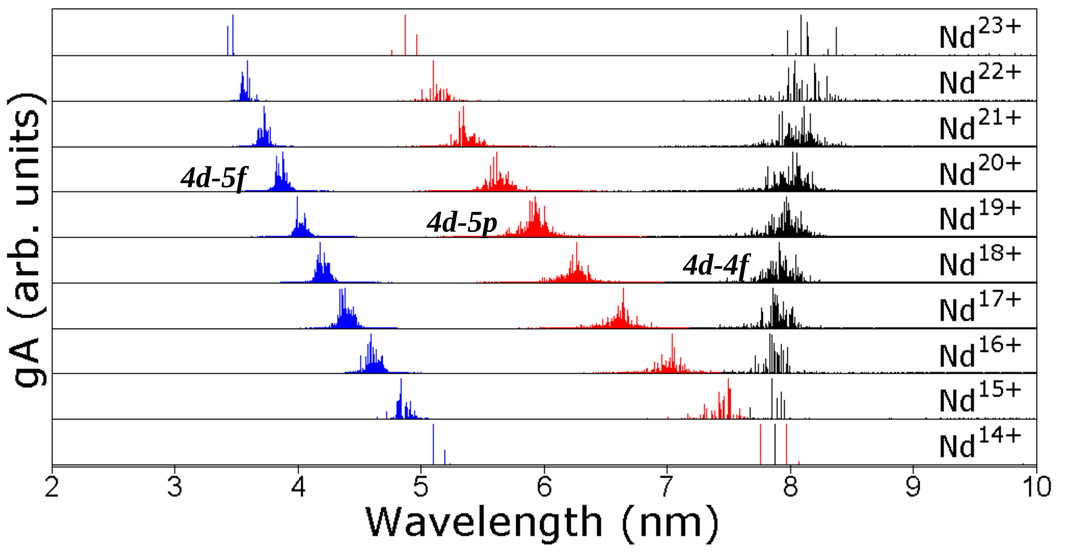

Figure 4: *Hartree-Fock with CI calculations for Nd using the Cowan suite of codes (courtesy of John Sheil)*

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