The CAMSS Meteoroid Elemental Abundance Applications and Modeling Results

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Introduction

The Cameras for All-sky Meteor Surveillance Spectroscopy (CAMSS) project [1] has been operationally collecting data since April 2013. Over 1000 spectra have been identified and archived for elemental abundance estimation. Along with those meteor spectra are the associated Solar System orbits derived from each of the CAMS coincident meteor trajectories, enabling an assignment of meteoroid composition to a parent body. The analysis work flow has been streamlined into several user interactive (UI) applications. The analysis team feels that the step-by-step procedures have reached full maturity and now analysis of all the spectra is underway. First results will be presented.

Methodology

The CAMSS system employs sixteen objective-grating low-light video cameras that operate every clear night from Sunnyvale, California. The sensor design, hardware configuration, video capture, automated spectrum detection, and data storage have been previously outlined [1]. The more recent focus has been on the calibration, extraction, and analysis tools with the automation/UI trade-offs necessary for analyzing a large quantity of high dispersion spectra in a consistent and efficient manner. Several GUI based analysis tools were created that include a sensor responsivity application, a bright star spectral catalog, atmospheric extinction modeling, spatial-temporal coincidence between CAMS and CAMSS tracks, astrometric mapping from trajectory to wavelength, a full set of elemental emission line metadata, both warm and hot plasma modeling, an algorithm for electron number density estimation [2], measurement extraction and calibration, spectral modeling formulations for neutrals and ions from both warm and hot components, and a GUI for element selection and model fit tuning.

Figure 1 shows the user interface of the spectral coincidence tool. Included in the tool are tunable parameters such as the user's choice of element contributors to the measured spectrum, the PSF emission line width, warm and hot plasma temperatures, air-mass adjustment to the extinction, the grating orientation relative to the sensor and its effective dispersion, warm to hot plasma volume ratio, and the column densities per element. Many of the spectral modeling formulations are based on [3-4].

Planned Activity and Goal

The three core applications for responsivity, extinction, and abundance estimation have been implemented and tested. The discussion will walk through the various modeling choices, algorithmic processing steps and preliminary analysis results of the current applications.

The goal for processing the large archive of spectra is that it will provide a year-round survey of the main elemental compositions (Mg, Fe, Na) of meteoroids from a diverse array of comets and asteroids that pass close to Earth.

References

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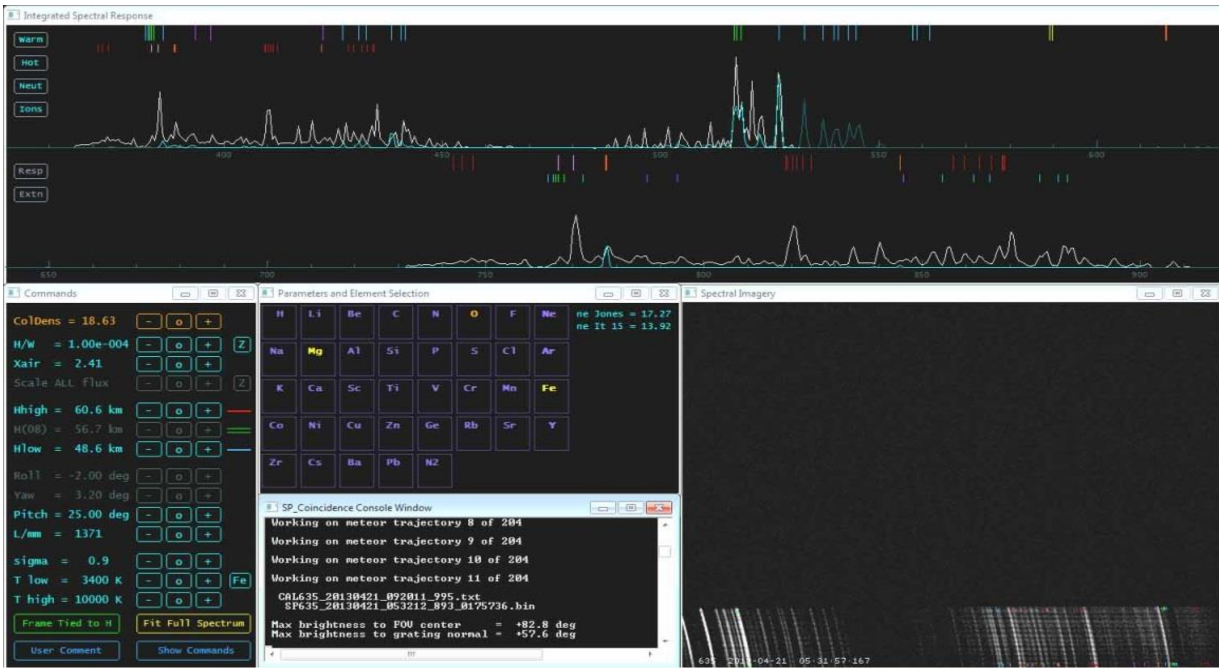

Fig. 1 Screen shot of the coincidence and elemental abundance estimation application SP_Coincidence.