# IMC 2018
# Spectroscopic Workshop I

August 2018

# Why?

to discuss meteor spectroscopic methodology and data format

to provide guidance for the meteor community

# Where to start?

IMO Photographic Handbook
"Part 3: Meteor Spectra"

https://www.imo.net/docs/03spectra.pdf

# Observations

(camera, grating, filter, spectral response determination)

- 8bit or higher digital cameras
- grating: plastic holographic (lower sensitivity),
  500-1000 groves/mm,
- filters: for IR region order-blocking
- stars (Vega)
- standard lamp (laboratory),
  e.g. LED sodium for $\lambda$ calibration but not abs. intensity,
  hologen for response calibration
- test linearity response
- raw uncompressed data

# Data Reduction

(dark & flat, radiometric calibration & geometric correction, wavelength calibration)

- master flat:
  – synthetic from set of images taken during a night
  – evenly illuminated surface (fog or low clouds)
- master dark: set of images with cap over the aperture
- local background from set imgages without meteor
- e.g.: a script, ImageJ,...
- wavelength calibration: lamps or use known lines (at least 3) with polynomial fitting,
- signal-read: adjustable width considering geometry of flights
- corrections, e.g. radiometric, geometric, atmospheric extinction

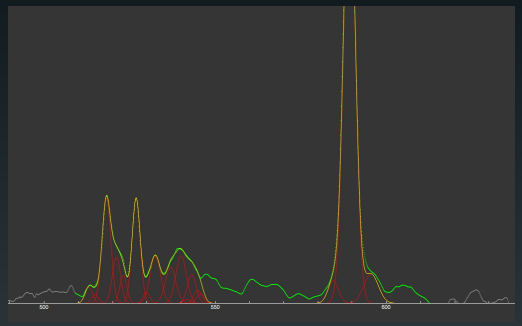
# Format of the data & Storage

Not all products are for distribution, but it could be beneficial to have them in similar format.

- Observer keeps raw data
- Shared data in FITS[1]
  - YYYYMMDDThhmmss.fits
  - observer, station/campaign, camera
  - corrections: dark/flat/atmospheric extinction...
  - data: wavelength, instrumental/relative intensity, calibrated relative intensity, calibration curve

[1] Hanisch, R. J., et al. (2001), *Definition of the Flexible Image Transport System (FITS)*, A&A, 376, 359

# Modelling



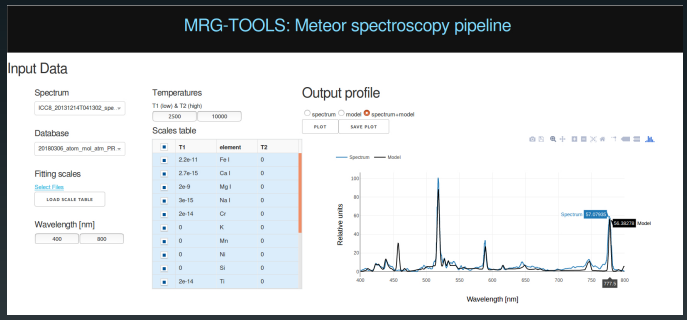
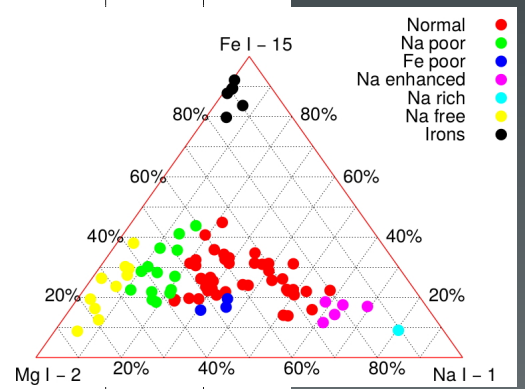



**Table 3-7:** List of spectral lines frequently found in meteor spectra and their relative intensities. The identification of the lines (numbers) in our example is also given. Lines marked with an asterisk appear bright in spectra of fast meteors, such as the Perseids, but much fainter in spectra of slow meteors.

| Laboratory data | | | ident. | Laboratory data | | | ident. |
|---|---|---|---|---|---|---|---|
| $\lambda_{lab}$, [Å] | atom/ion | intensity | number | $\lambda_{lab}$, [Å] | atom/ion | intensity | number |
| 3719.9 | Fe | 10 | 2 | 4923.9 | $Fe^+$ | 2* | |
| 3734.9 | Fe | 8 | | 4957.6 | Fe | 4 | |
| 3737.1 | Fe | 9 | 3 | 5012.1 | Fe | 1 | |
| 3745.6 | Fe | 8 | | 5018.4 | $Fe^+$ | 3* | |
| 3749.5 | Fe | 8 | | 5110.4 | Fe | 1 | |
| 3820.4 | Fe | 9 | | 5167.3 | Mg | | |
| 3825.9 | Fe | 8 | | 5172.7 | Mg | | |
| 3829.4 | Mg | 10 | | 5183.6 | Mg | | |
| 3832.3 | Mg | 11 | | 5208.4 | Cr | | |
| 3838.3 | Mg | 12 | | 5227.2 | Fe | | |
| 3859.9 | Fe | 11 | | 5269.5 | Fe | | |
| 3886.3 | Fe | 9 | | 5328.0 | Fe | | |
| 3933.7 | $Ca^+$ | 40* | 8 | 5371.5 | Fe | | |
| 3968.5 | $Ca^+$ | 35* | 9 | 5397.1 | Fe | | |
| 4030.8 | Mn | 10 | | 5405.8 | Fe | | |
| 4045.8 | Fe | 10 | | 5429.7 | Fe | | |
| 4063.6 | Fe | 9 | | 5434.5 | Fe | | |
| 4131.0 | $Si^+$ | 1* | | 5446.9 | Fe | | |
| 4226.7 | Ca | 11 | 12 | 5455.6 | Fe | | |
| 4254.4 | Cr | 9 | | 5528.4 | Mg | 2 | |
| 4271.8 | Fe | 10 | | 5615.7 | Fe | 1 | |
| 4274.8 | Cr | 8 | | 5890.0 | Na | 40 | |
| 4289.7 | Cr | 7 | | 5895.9 | Na | 35 | |
| 4307.9 | Fe | 10 | | 6156.8 | O | 1* | |



# Advert


## Apply

### Student placement

Last or penultimate year of a MSc degree.

(engineers, physicists, biologists, business graduates, and lawyers)

### Young Graduate Trainee (YGT)

In finals or MSc degree.

### Postdoctoral Research Fellowship (RF)

PhD degree.

`http://www.esa.int/About_Us/Careers_at_ESA`