

Lunar and Planetary Science Conference, March 16th, 2014

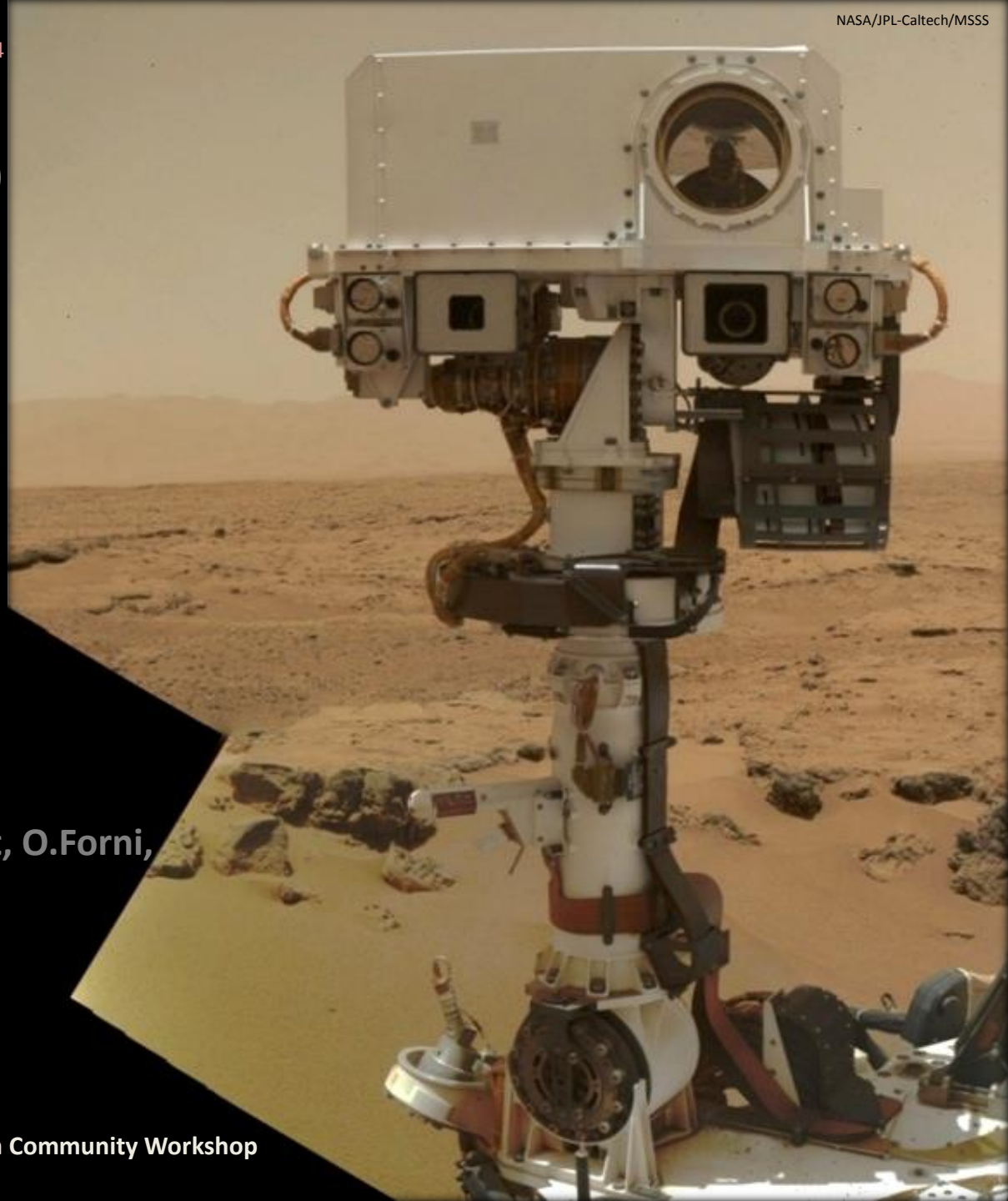
COMMUNITY USER WORKSHOP
ON PLANETARY LIBS (CHEMCAM)
DATA

C-QuEST

Software

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A. Cousin, S. Maurice, O. Gasnault, O.Forni,
R. Wiens and ChemCam team





What is C-QuEST ?

Definition

- ChemCam Quick Element Search Tool
- Library of ChemCam emission lines for 32 elements

Why use it ?

- Search for specific element in spectral database
- Search for specific spectral range
- Visualize an elemental synthetic spectrum

LIBS emission lines database

Why doing an emission lines library ?

NIST

*Not LIBS specific
Vacuum and Ambient*

CREOSA

*LIBS specific
Helium*



Emission lines are dependent on the experimental conditions
(Pressure, Laser Energy, ..)



Need for a specific Martian database
Subset of the NIST database



File Help

Databases

- NIST
 Martian (Agnes Cousin)

Wavelength (nm)

- UV (240-341) VIS (381-469) VNIR (471-905)
 Min 0 Max 1,000

Periodic Table

 Major Trace Organic (CHNOPS) Other

| | | | | | | | | | | | | | | | | | | |
|----|----|----|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|----|--|
| H | | | | | | | | | | | | | | | | | He | |
| Li | Be | | | | | | | | | | | B | C | N | O | F | Ne | |
| Na | Mg | | | | | | | | | | | Al | Si | P | S | Cl | Ar | |
| K | Ca | Sc | Ti | V | Cr | Mn | Fe | Co | Ni | Cu | Zn | Ga | Ge | As | Se | Br | Kr | |
| Rb | Sr | Y | Zr | Nb | Mo | Tc | Ru | Rh | Pd | Ag | Cd | In | Sn | Sb | Te | I | Xe | |
| Cs | Ba | La | Hf | Ta | W | Re | Os | Ir | Pt | Au | Hg | Tl | Pb | Bi | Po | At | Rn | |
| Fr | Ra | Ac | Unq | Unp | Unh | Uns | Uno | Unu | | | | | | | | | | |
| | | | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu | | |
| | | | Th | Pa | U | Np | Pu | Am | Cm | Bk | Cf | Es | Fm | Md | No | Lr | | |

Informations

| Db | Elt | Ionizati... | Wavelen... | Intensity ... |
|----|-----|-------------|------------|---------------|
| | | | | |

Nb lines : 0

Print

Spectra

Choice between NIST and ChemCam database

C-QuEST - ChemCam - Quick Element Search Tool v2.5.0 (16 Aug 2012)

File Help

Databases

NIST

Martian (Agnes Cousin)

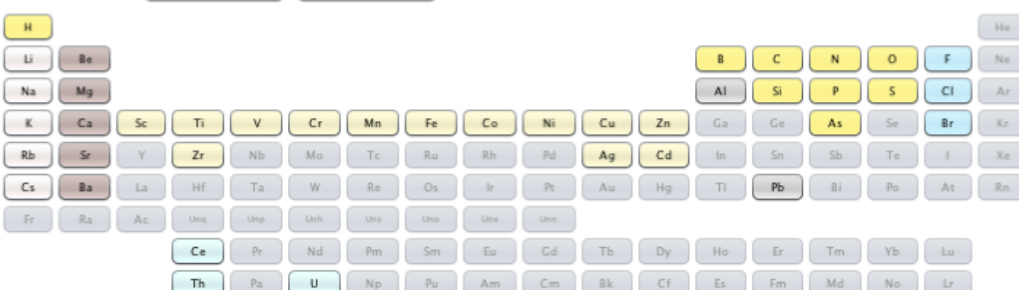
Wavelength (nm)

UV (240-341) VIS (381-469) VNIR (471-905)

Min Max

Periodic Table

Major Trace Organic (CHNOPS) Other



Informations

Db Elt Ionizati... Wavelen... Intensity ...

Nb lines : 0

Print

Spectra



File Help

Databases

- NIST
 Martian (Agnes Cousin)

Wavelength (nm)

- UV (240-341) VIS (381-469) VNIR (471-905)

Min Max

Search for a specific spectral range

Periodic Table

 Major Trace Organic (CHNOPS) Other

| | | | | | | | | | | | | | | | | | |
|----|----|----|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|
| H | | | | | | | | | | | | | | | | | He |
| Li | Be | | | | | | | | | | | B | C | N | O | F | Ne |
| Na | Mg | | | | | | | | | | | Al | Si | P | S | Cl | Ar |
| K | Ca | Sc | Ti | V | Cr | Mn | Fe | Co | Ni | Cu | Zn | Ga | Ge | As | Se | Br | Kr |
| Rb | Sr | Y | Zr | Nb | Mo | Tc | Ru | Rh | Pd | Ag | Cd | In | Sn | Sb | Te | I | Xe |
| Cs | Ba | La | Hf | Ta | W | Re | Os | Ir | Pt | Au | Hg | Tl | Pb | Bi | Po | At | Rn |
| Fr | Ra | Ac | Unq | Unp | Unh | Uns | Uno | Unu | Uuu | | | | | | | | |
| | | | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu | |
| | | | Th | Pa | U | Np | Pu | Am | Cm | Bk | Cf | Es | Fm | Md | No | Lr | |

Informations

Db Elt Ionizati... Wavelen... Intensity ...

Nb lines : 0

Print

Spectra



File Help

Databases

- NIST
 Martian (Agnes Cousin)

Wavelength (nm)

UV (240-341) VIS (381-469) VNIR (471-905)

Min Max

*Search for a specific
element*

Periodic Table

Major Trace Organic (CHNOPS) Other

| | | | | | | | | | | | | | | | | | |
|----|----|----|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|
| H | | | | | | | | | | | | | | | | | He |
| Li | Be | | | | | | | | | | | B | C | N | O | F | Ne |
| Na | Mg | | | | | | | | | | | Al | Si | P | S | Cl | Ar |
| K | Ca | Sc | Ti | V | Cr | Mn | Fe | Co | Ni | Cu | Zn | Ga | Ge | As | Se | Br | Kr |
| Rb | Sr | Y | Zr | Nb | Mo | Tc | Ru | Rh | Pd | Ag | Cd | In | Sn | Sb | Te | I | Xe |
| Cs | Ba | La | Hf | Ta | W | Re | Os | Ir | Pt | Au | Hg | Tl | Pb | Bi | Po | At | Rn |
| Fr | Ra | Ac | Unq | Unp | Unh | Uns | Uno | Une | Uue | | | | | | | | |
| | | | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu | |
| | | | Th | Pa | U | Np | Pu | Am | Cm | Bk | Cf | Es | Fm | Md | No | Lr | |

Informations

Db | Elt | Ionizati... | Wavelen... | Intensity ...

Nb lines : 0

Print

Spectra



File Help

Databases

- NIST
- Martian (Agnes Cousin)

Wavelength (nm)

UV (240-341)
 VIS (381-469)
 VNIR (471-905)

Min
 Max

Periodic Table

 Major
 Trace
 Organic (CHNOPS)
 Other

Informations

The most intense one is at 455.53 nm. There are some interferences with Ti lines, but no confusion. This is the line that ensures the presence of Ba in a spectrum.

58: Cerium

82: Lead

90: Thorium

92: Uranium

| Db | Elt | Ioniza... | Wavele... ▲ | Intensity ... |
|---------|-----|-----------|-------------|---------------|
| Martian | Fe | I | 300.039 | 76.994 |
| Martian | V | II | 300.207 | 522.527 |
| Martian | Ni | I | 300.337 | 11.184 |
| Martian | Fe | II | 300.352 | 258.952 |
| Martian | Ni | I | 300.451 | 236.055 |
| Martian | Mn | I | 300.854 | 28.107 |
| Martian | Fe | I | 300.902 | 86.970 |
| Martian | Cu | I | 301.172 | 8.228 |
| Martian | Mn | I | 301.204 | 41.185 |
| Martian | Mn | I | 301.226 | 41.185 |
| Martian | Ni | I | 301.288 | 288.071 |
| Martian | Fe | III | 301.405 | 10.424 |
| Martian | Mn | I | 301.555 | 43.700 |
| Martian | Ti | II | 301.807 | 2.619 |
| Martian | Ni | I | 302.002 | 39.155 |
| Martian | Mn | II | 302.080 | 476.444 |
| Martian | Fe | I | 302.137 | 204.569 |
| Martian | Fe | I | 302.152 | 132.304 |
| Martian | Fe | I | 302.195 | 132.304 |
| Martian | Mn | I | 302.363 | 182.195 |
| Martian | Fe | I | 302.672 | 60.710 |
| Martian | Ti | II | 303.061 | 2.221 |
| Martian | Mn | II | 303.194 | 594.236 |
| Martian | V | II | 303.433 | 886.474 |
| Martian | V | II | 303.470 | 886.474 |
| Martian | Mn | II | 303.623 | 360.566 |
| Martian | Zn | I | 303.666 | 36.211 |
| Martian | Cu | I | 303.698 | 8.539 |
| Martian | Fe | I | 303.827 | 46.509 |
| Martian | Ni | I | 303.882 | 11.184 |
| Martian | Mn | I | 304.148 | 334.049 |
| Martian | Fe | I | 304.252 | 28.551 |
| Martian | Mn | I | 304.546 | 209.186 |
| Martian | Ti | II | 304.757 | 1.760 |
| Martian | Mn | I | 304.793 | 209.186 |
| Martian | Fe | I | 304.849 | 11.184 |
| Martian | V | II | 304.911 | 1,097.2... |
| Martian | Mn | II | 305.154 | 349.718 |
| Martian | Ni | I | 305.170 | 189.878 |
| Martian | V | II | 305.428 | 117.904 |
| Martian | Ni | I | 305.520 | 41.308 |
| Martian | Mn | I | 305.525 | 42.558 |

Nb lines : 126



File Help

Databases

Wavelength (nm)

- NIST
- Martian (Agnes Cousin)

UV (240-341)
 VIS (381-469)
 VNIR (471-905)

Min
 Max

Periodic Table

 Major
 Trace
 Organic (CHNOPS)
 Other

Informations

The Calcium shows as generally 2 lines in the UV domain, located at 315.978 nm and at 318.025 nm. If these two lines are not observed, the sample does not contain Ca.

20: Calcium

Ca shows several important lines. Here are the most ones, observed for each spectral range :

- UV : 315.978 nm and 318.025 nm
- VIS : 393.477 nm, 396.959 nm and 422.792 nm are the most important among others
- VNIR : lot of Ca lines. The most easy ones to detect are the triplet at 610.441, 612.39 and 616.3 nm with an increasing intensity, and a second triplet at 644.085, 645.159 and 646.436-646.557 nm with a decreasing intensity.

All these lines are well defined with no interferences.
 The most important Ca lines in all the spectrum are those at 393.477 nm and 396.959 nm, but they can suffer some auto-absorption effects.

26: Iron

| Db | Elt | Ionizati... | Wavele... | Intensity ... |
|---------|-----|-------------|-----------|---------------|
| Martian | Fe | I | 300.039 | 76.994 |
| Martian | Fe | II | 300.352 | 258.952 |
| Martian | Fe | I | 300.902 | 86.970 |
| Martian | Fe | III | 301.405 | 10.424 |
| Martian | Fe | I | 302.137 | 204.569 |
| Martian | Fe | I | 302.152 | 132.304 |
| Martian | Fe | I | 302.195 | 132.304 |
| Martian | Fe | I | 302.672 | 60.710 |
| Martian | Fe | I | 303.827 | 46.509 |
| Martian | Fe | I | 304.252 | 28.551 |
| Martian | Fe | I | 304.849 | 11.184 |
| Martian | Fe | I | 305.833 | 132.755 |
| Martian | Fe | I | 305.998 | 11.184 |
| Martian | Fe | I | 306.814 | 53.376 |
| Martian | Fe | I | 307.661 | 84.976 |
| Martian | Al | I | 308.305 | 797.742 |
| Martian | Al | II | 308.941 | 44.827 |
| Martian | Fe | I | 309.247 | 10.839 |
| Martian | Al | I | 309.361 | 718.594 |
| Martian | Al | I | 309.374 | 1,369.8.. |
| Martian | Mg | I | 309.388 | 46.616 |
| Martian | Na | II | 309.645 | 69.978 |
| Martian | Mg | I | 309.779 | 94.835 |
| Martian | Fe | I | 310.120 | 88.149 |
| Martian | Na | II | 312.612 | 80.808 |
| Martian | Fe | II | 315.512 | 77.237 |
| Martian | Ca | II | 315.978 | 449.694 |
| Martian | Fe | III | 317.501 | 4.460 |
| Martian | Fe | III | 317.893 | 37.426 |
| Martian | Ca | II | 318.025 | 700.170 |
| Martian | Fe | I | 318.582 | 11.853 |
| Martian | Fe | I | 319.422 | 56.373 |
| Martian | Si | II | 319.561 | 254.413 |
| Martian | Fe | I | 319.785 | 46.588 |

Nb lines : 34



File Help

Databases

- NIST
- Martian (Agnes Cousin)

Wavelength (nm)

- UV (240-341)
- VIS (381-469)
- VNIR (471-905)

Min Max

Periodic Table

Major
 Trace
 Organic (CHNOPS)
 Other

| | | | | | | | | | | | | | | | | | |
|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|
| H | | | | | | | | | | | | | | | | | He |
| Li | Be | | | | | | | | | | | B | C | N | O | F | Ne |
| Na | Mg | | | | | | | | | | | Al | Si | P | S | Cl | Ar |
| K | Ca | Sc | Ti | V | Cr | Mn | Fe | Co | Ni | Cu | Zn | Ga | Ge | As | Se | Br | Kr |
| Rb | Sr | Y | Zr | Nb | Mo | Tc | Ru | Rh | Pd | Ag | Cd | In | Sn | Sb | Te | I | Xe |
| Cs | Ba | La | Hf | Ta | W | Re | Os | Ir | Pt | Au | Hg | Tl | Pb | Bi | Po | At | Rn |
| Fr | Ra | Ac | Uuq | Uup | Uuh | Uus | Uuo | Uuq | Uuq | Uuq | Uuq | | | | | | |
| | | | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu | |
| | | | Th | Pa | U | Np | Pu | Am | Cm | Bk | Cf | Es | Fm | Md | No | Lr | |

Informations

| Db | Elt | Ionizati... | Wavelen... | Intensity ... |
|----|-----|-------------|------------|---------------|
| | | | | |

Nb lines : 0



File Help

Databases

- NIST
 Martian (Agnes Cousin)

Wavelength (nm)

- UV (240-341) VIS (381-469) VNIR (471-905)
 Min Max

Periodic Table

SELECT ALL CLEAR ALL Major Trace Organic (CHNOPS) Other

Al will be the example

| | | | | | | | | | | | | | | | | | |
|----|----|----|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|
| H | | | | | | | | | | | | | | | | | He |
| Li | Be | | | | | | | | | | | B | C | N | O | F | Ne |
| Na | Mg | | | | | | | | | | | Al | Si | P | S | Cl | Ar |
| K | Ca | Sc | Ti | V | Cr | Mn | Fe | Co | Ni | Cu | Zn | Ga | Ge | As | Se | Br | Kr |
| Rb | Sr | Y | Zr | Nb | Mo | Tc | Ru | Rh | Pd | Ag | Cd | In | Sn | Sb | Te | I | Xe |
| Cs | Ba | La | Hf | Ta | W | Re | Os | Ir | Pt | Au | Hg | Tl | Pb | Bi | Po | At | Rn |
| Fr | Ra | Ac | Unq | Unp | Unk | Uns | Uno | Une | Uun | | | | | | | | |
| | | | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu | |
| | | | Th | Pa | U | Np | Pu | Am | Cm | Bk | Cf | Es | Fm | Md | No | Lr | |

Informations

13: Aluminium

Al shows several lines in all the spectral range.

The most characteristic lines are :

- UV : 2 lines at 308.305 nm and at 309.36-309.37 nm which are neutral lines. These lines are often interfered by Ti lines, but are still well characterized.
- VIS : 2 lines are observed, which are the 2 most important lines of the Al. They are observed at 394.512 nm and 396.264 nm (neutral lines).
- VNIR : the most important ones are observed at 704.4 nm and 705.85 nm.

| Db | Elt | Ionizati... | Wave... | Intensity ... |
|---------|-----|-------------|---------|---------------|
| Martian | Al | I | 308.305 | 797.742 |
| Martian | Al | II | 308.941 | 44.827 |
| Martian | Al | I | 309.361 | 718.594 |
| Martian | Al | I | 309.374 | 1,369.8... |

Nb lines : 4

Print

Spectra



File Help

Databases

- NIST
 Martian (Agnes Cousin)

Wavelength (nm)

- UV (240-341) VIS (381-469) VNIR (471-905)
 Min Max

Periodic Table

Major Trace Organic (CHNOPS) Other

| | | | | | | | | | | | | | | | | | | | |
|----|----|----|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|--|----|
| H | | | | | | | | | | | | | | | | | | | He |
| Li | Be | | | | | | | | | B | C | N | O | F | Ne | | | | |
| Na | Mg | | | | | | | | | Al | Si | P | S | Cl | Ar | | | | |
| K | Ca | Sc | Ti | V | Cr | Mn | Fe | Co | Ni | Cu | Zn | Ga | Ge | As | Se | Br | Kr | | |
| Rb | Sr | Y | Zr | Nb | Mo | Tc | Ru | Rh | Pd | Ag | Cd | In | Sn | Sb | Te | I | Xe | | |
| Cs | Ba | La | Hf | Ta | W | Re | Os | Ir | Pt | Au | Hg | Tl | Pb | Bi | Po | At | Rn | | |
| Fr | Ra | Ac | Unq | Unp | Unk | Uns | Uno | Une | Uun | | | | | | | | | | |
| | | | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu | | | |
| | | | Th | Pa | U | Np | Pu | Am | Cm | Bk | Cf | Es | Fm | Md | No | Lr | | | |

Informations

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- VNIR : the most important ones are observed at 704.4 nm and 705.85 nm.

Information about main emission lines

| Db | Elt | Ionizati... | Wave... | Intensity ... |
|---------|-----|-------------|---------|---------------|
| Martian | Al | I | 308.305 | 797.742 |
| Martian | Al | II | 308.941 | 44.827 |
| Martian | Al | I | 309.361 | 718.594 |
| Martian | Al | I | 309.374 | 1,369.8... |

Nb lines : 4

Print

Spectra

C-QuEST - ChemCam - Quick Element Search Tool v2.5.0 (16 Aug 2012)

File Help

Databases

NIST
 Martian (Agnes Cousin)

Wavelength (nm)

UV (240-341) VIS (381-469) VNIR (471-905)

Min 300 Max 320

Periodic Table

Major Trace Organic (CHNOPS) Other

| | | | | | | | | | | | | | | | | | | | |
|----|----|----|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|--|--|----|
| H | | | | | | | | | | | | | | | | | | | He |
| Li | Be | | | | | | | | | B | C | N | O | F | | | | | Ne |
| Na | Mg | | | | | | | | | Al | Si | P | S | Cl | | | | | Ar |
| K | Ca | Sc | Ti | V | Cr | Mn | Fe | Co | Ni | Cu | Zn | Ga | Ge | As | Se | Br | | | Kr |
| Rb | Sr | Y | Zr | Nb | Mo | Tc | Ru | Rh | Pd | Ag | Cd | In | Sn | Sb | Te | I | | | Xe |
| Cs | Ba | La | Hf | Ta | W | Re | Os | Ir | Pt | Au | Hg | Tl | Pb | Bi | Po | At | | | Rn |
| Fr | Ra | Ac | Uuq | Uup | Uuh | Uus | Uuo | Uuq | Uuq | | | | | | | | | | |
| | | | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu | | | |
| | | | Th | Pa | U | Np | Pu | Am | Cm | Bk | Cf | Es | Fm | Md | No | Lr | | | |

Information

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| Db | Elt | Ionizati... | Wavele... | Intensity ... |
|---------|-----|-------------|-----------|---------------|
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| Martian | Al | I | 309.361 | 718.594 |
| Martian | Al | I | 309.374 | 1,369.8... |

Nb lines : 4

List of the Al lines present in the database between 300 - 320 nm



File Help

Databases

- NIST
 Martian (Agnes Cousin)

Wavelength (nm)

- UV (240-341) VIS (381-469) VNIR (471-905)
 Min Max

Periodic Table

Major Trace Organic (CHNOPS) Other

| | | | | | | | | | | | | | | | | | | | |
|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|--|----|
| H | | | | | | | | | | | | | | | | | | | He |
| Li | Be | | | | | | | | | B | C | N | O | F | Ne | | | | |
| Na | Mg | | | | | | | | | Al | Si | P | S | Cl | Ar | | | | |
| K | Ca | Sc | Ti | V | Cr | Mn | Fe | Co | Ni | Cu | Zn | Ga | Ge | As | Se | Br | Kr | | |
| Rb | Sr | Y | Zr | Nb | Mo | Tc | Ru | Rh | Pd | Ag | Cd | In | Sn | Sb | Te | I | Xe | | |
| Cs | Ba | La | Hf | Ta | W | Re | Os | Ir | Pt | Au | Hg | Tl | Pb | Bi | Po | At | Rn | | |
| Fr | Ra | Ac | Unq | Unp | Unh | Unl | Uun | Uun | Uun | Uun | Uun | | | | | | | | |
| | | | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu | | | |
| | | | Th | Pa | U | Np | Pu | Am | Cm | Bk | Cf | Es | Fm | Md | No | Lr | | | |

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| Martian | Al | I | 309.361 | 718.594 |
| Martian | Al | I | 309.374 | 1,369.8... |

To print the list of emission lines

Nb lines : 4

Spectra



File Help

Databases

- NIST
 Martian (Agnes Cousin)

Wavelength (nm)

- UV (240-341) VIS (381-469) VNIR (471-905)
 Min Max

Periodic Table

Major Trace Organic (CHNOPS) Other

| | | | | | | | | | | | | | | | | | | | |
|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|--|--|----|
| H | | | | | | | | | | | | | | | | | | | He |
| Li | Be | | | | | | | | | B | C | N | O | F | | | | | Ne |
| Na | Mg | | | | | | | | | Al | Si | P | S | Cl | | | | | Ar |
| K | Ca | Sc | Ti | V | Cr | Mn | Fe | Co | Ni | Cu | Zn | Ga | Ge | As | Se | Br | | | Kr |
| Rb | Sr | Y | Zr | Nb | Mo | Tc | Ru | Rh | Pd | Ag | Cd | In | Sn | Sb | Te | I | | | Xe |
| Cs | Ba | La | Hf | Ta | W | Re | Os | Ir | Pt | Au | Hg | Tl | Pb | Bi | Po | At | | | Rn |
| Fr | Ra | Ac | Uuq | Uup | Uub | Uuq | Uus | Uuo | Uue | Uuq | | | | | | | | | |
| | | | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu | | | |
| | | | Th | Pa | U | Np | Pu | Am | Cm | Bk | Cf | Es | Fm | Md | No | Lr | | | |

Informations

13: Aluminium

Al shows several lines in all the spectral range.

The most characteristic lines are :

- UV : 2 lines at 308.305 nm and at 309.36-309.37 nm which are neutral lines. These lines are often interfered by Ti lines, but are still well characterized.
- VIS : 2 lines are observed, which are the 2 most important lines of the Al. They are observed at 394.512 nm and 396.264 nm (neutral lines).
- VNIR : the most important ones are observed at 704.4 nm and 705.85 nm.

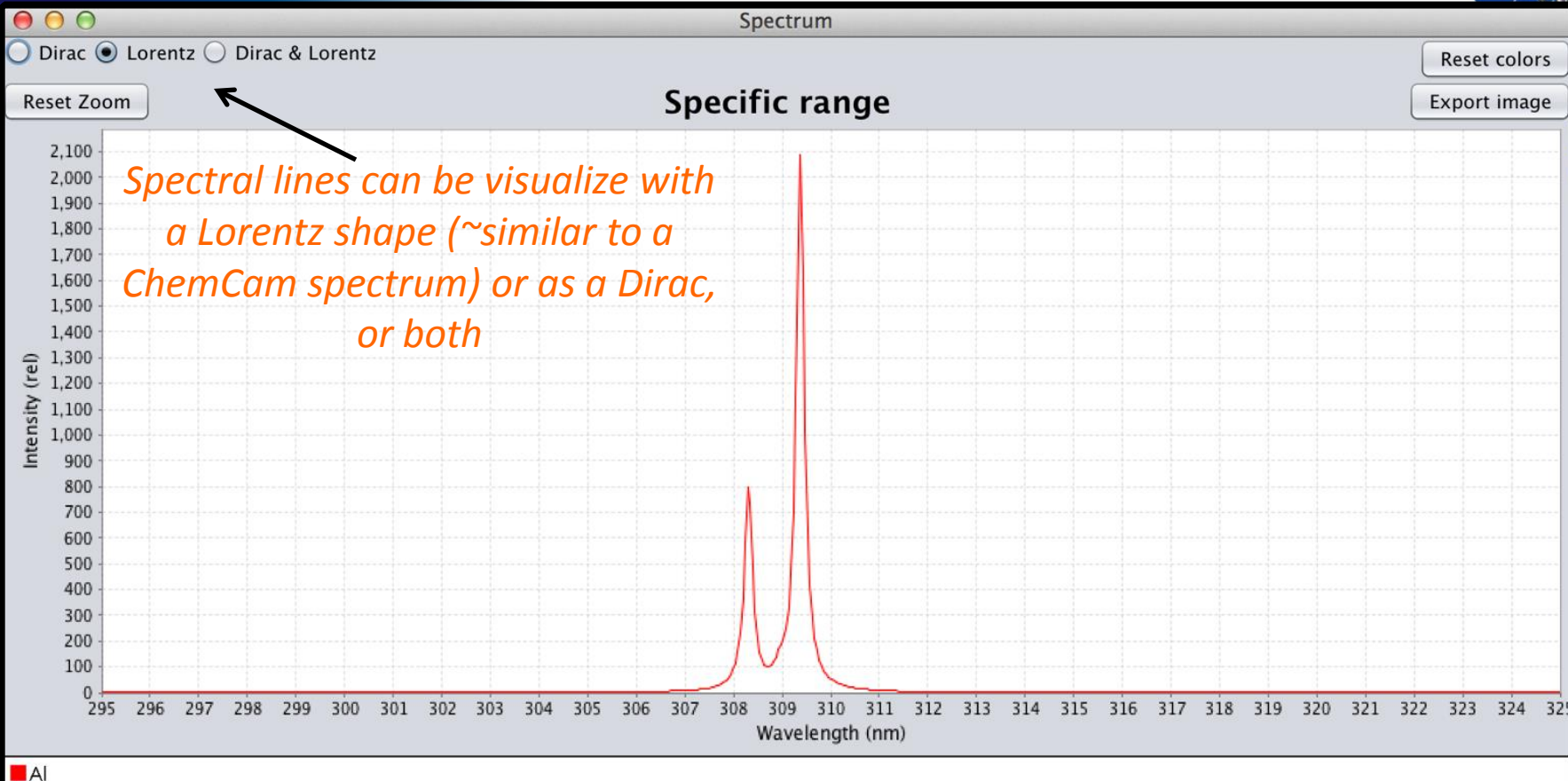
| Db | Elt | Ionizati... | Wavele... ▲ | Intensity ... |
|---------|-----|-------------|-------------|---------------|
| Martian | Al | I | 308.305 | 797.742 |
| Martian | Al | II | 308.941 | 44.827 |
| Martian | Al | I | 309.361 | 718.594 |
| Martian | Al | I | 309.374 | 1,369.8... |

To visualize the spectrum/spectra, only 1 database should be selected (NIST or Martian)

Nb lines : 4

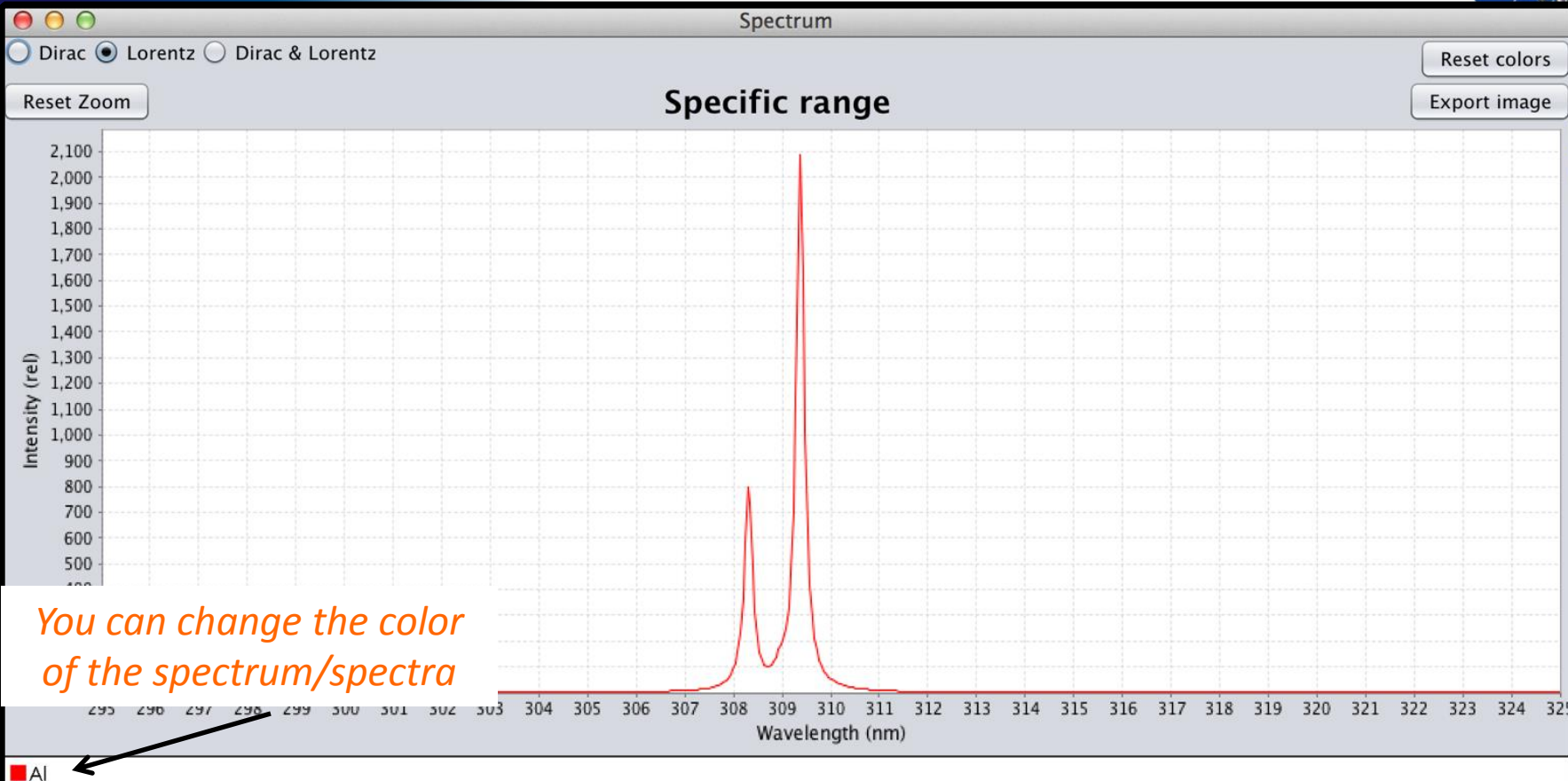
Print

Spectra



often interfered by Ti lines, but are still well characterized.

- VIS : 2 lines are observed, which are the 2 most important lines of the Al. They are observed at 394.512 nm and 396.264 nm (neutral lines).
- VNIR : the most important ones are observed at 704.4 nm and 705.85 nm.



You can change the color of the spectrum/spectra

often interfered by Ti lines, but are still well characterized.

- VIS : 2 lines are observed, which are the 2 most important lines of the Al. They are observed at 394.512 nm and 396.264 nm (neutral lines).
- VNIR : the most important ones are observed at 704.4 nm and 705.85 nm.



Spectrum

Dirac Lorentz Dirac & Lorentz

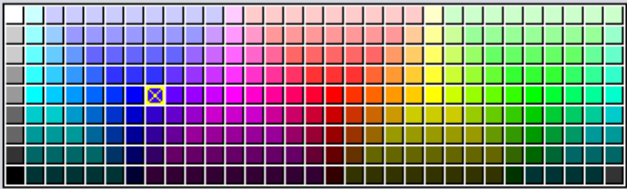
Reset colors

Export image

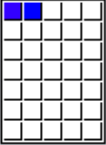
Specific range

Choose a color

Swatches HSV HSL RGB CMYK



Recent:



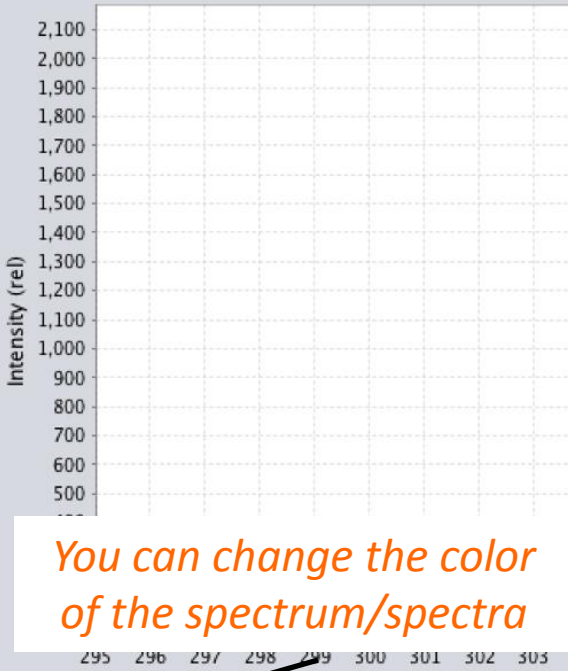
Preview

Sample Text Sample Text

Sample Text Sample Text

Sample Text Sample Text

OK Cancel Reset



You can change the color of the spectrum/spectra



Al

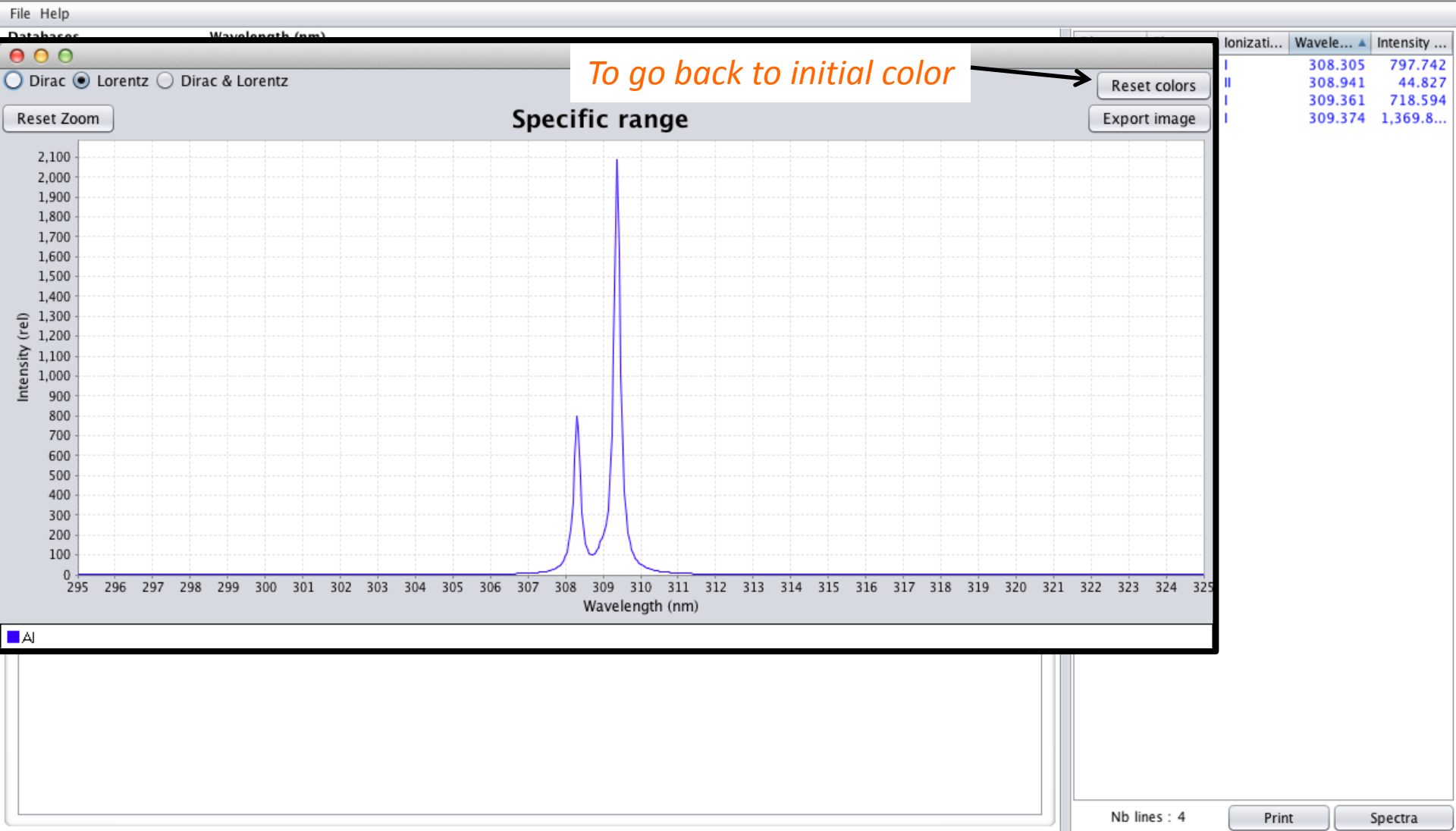
often interfered by Ti lines, but are still well characterized.

- VIS : 2 lines are observed, which are the 2 most important lines of the 394.512 nm and 396.264 nm (neutral lines).
- VNIR : the most important ones are observed at 704.4 nm and 705.85 nm.

Nb lines : 4

Print

Spectra





File Help

Databases

Wavelength (nm)

Dirac Lorentz Dirac & Lorentz

Reset Zoom

Specific range

Reset colors

Export image

Intensity (rel)

Look In: agnescousin

- Applications
- Desktop
- Documents
- Downloads
- Dropbox
- IDL_Libraries
- IDLWorkspace81
- IDLWorkspace82
- Islanda
- Library
- Mariage
- Movies
- Music
- Pictures
- Program

File Name: Lines_AI_300_320nm

Files of Type: Format .png (Portable Network Graphics)

Export Cancel

| Ionizati... | Wavele... | Intensity ... |
|-------------|-----------|---------------|
| I | 308.305 | 797.742 |
| II | 308.941 | 44.827 |
| I | 309.361 | 718.594 |
| I | 309.374 | 1,369.8... |

Nb lines : 4

Print Spectra

Example with several elements

C-QuEST - ChemCam - Quick Element Search Tool v2.5.0 (16 Aug 2012)

File Help

Databases

NIST
 Martian (Agnes Cousin)

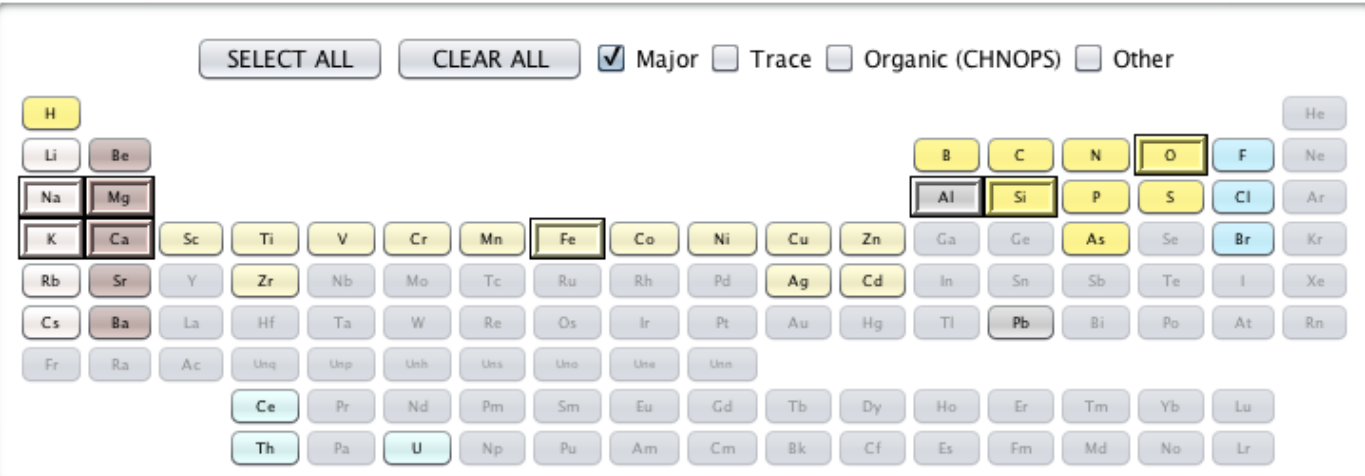
Wavelength (nm)

UV (240-341) VIS (381-469) VNIR (471-905)

Min Max

Periodic Table

Major Trace Organic (CHNOPS) Other



Informations

19: Potassium

The Potassium shows us generally 2 lines in the VNIR domain, located at 766.70 nm and at 770.11 nm. If these two lines are not observed, the sample does not contain K.

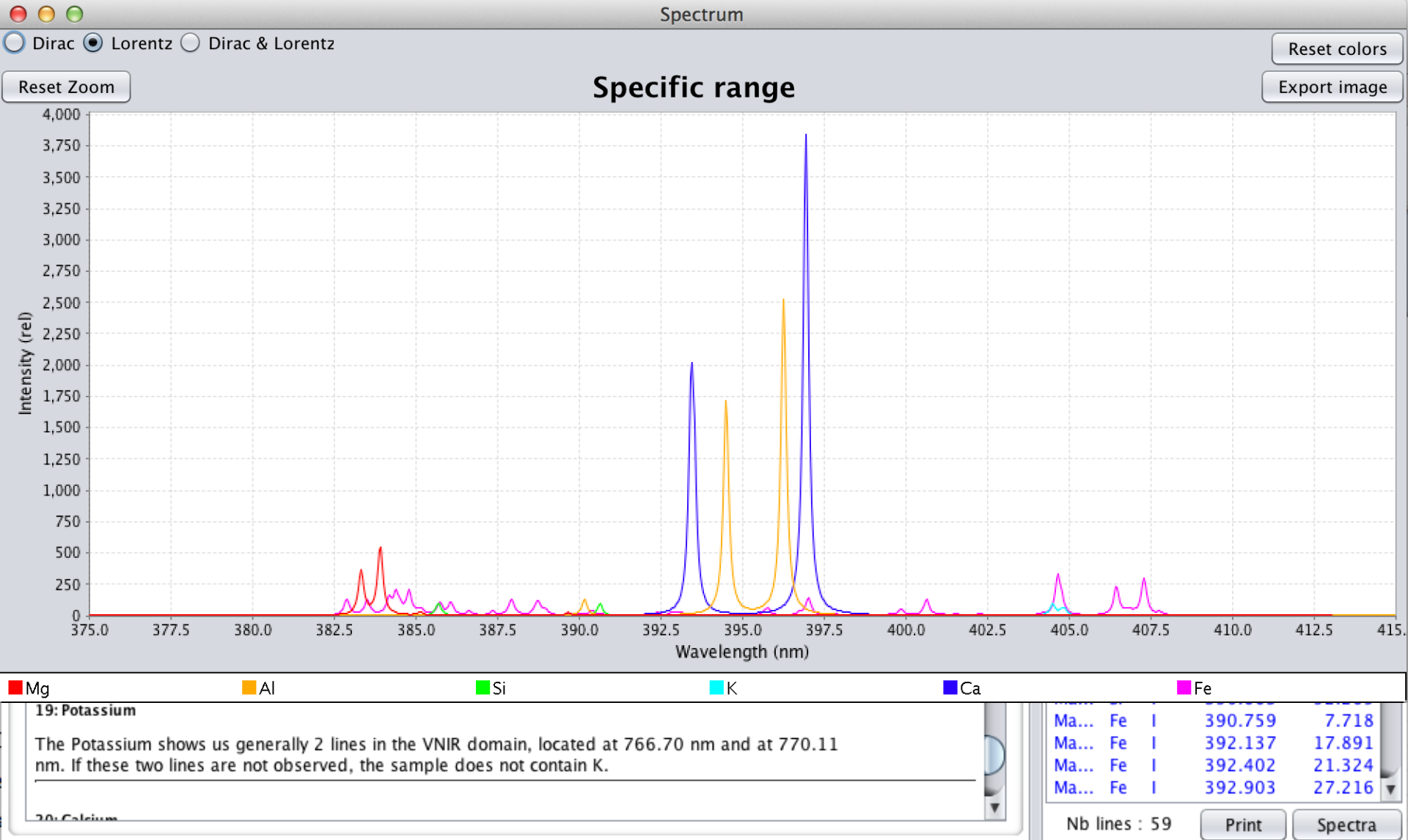
20: Calcium

| Db | Elt | I... | Wavelen... | Intensity... |
|-------|-----|------|------------|--------------|
| Ma... | Fe | I | 382.891 | 123.040 |
| Ma... | Mg | I | 383.339 | 348.572 |
| Ma... | Fe | I | 383.531 | 119.010 |
| Ma... | Mg | I | 383.938 | 550.271 |
| Ma... | Fe | I | 384.214 | 124.963 |
| Ma... | Fe | I | 384.435 | 170.888 |
| Ma... | Fe | I | 384.789 | 180.731 |
| Ma... | Fe | I | 385.105 | 25.079 |
| Ma... | Mg | II | 385.148 | 27.250 |
| Ma... | Fe | I | 385.191 | 25.079 |
| Ma... | Si | II | 385.711 | 97.816 |
| Ma... | Fe | I | 385.747 | 97.816 |
| Ma... | Fe | I | 386.100 | 99.896 |
| Ma... | Fe | I | 386.662 | 29.485 |
| Ma... | Fe | I | 387.360 | 28.300 |
| Ma... | Fe | I | 387.912 | 42.953 |
| Ma... | Fe | I | 387.967 | 87.629 |
| Ma... | Fe | I | 388.738 | 87.009 |
| Ma... | Fe | I | 388.815 | 38.716 |
| Ma... | Fe | I | 388.961 | 29.944 |
| Ma... | Mg | I | 389.668 | 25.116 |
| Ma... | Fe | I | 389.676 | 11.379 |
| Ma... | Fe | I | 390.081 | 16.824 |
| Ma... | Al | II | 390.178 | 126.093 |
| Ma... | Fe | I | 390.405 | 40.857 |
| Ma... | Si | I | 390.663 | 92.265 |
| Ma... | Fe | I | 390.759 | 7.718 |
| Ma... | Fe | I | 392.137 | 17.891 |
| Ma... | Fe | I | 392.402 | 21.324 |
| Ma... | Fe | I | 392.903 | 27.216 |

Nb lines : 59



Example with several elements



TIPS

- To visualize a synthetic spectrum, it is better to select only 1 spectral range (UV, VIS or VNIR) :
 - Data acquired with commercial spectrometers without a demultiplexer (each spectral range acquired separately)
 - Total intensity from one domain to another can be different

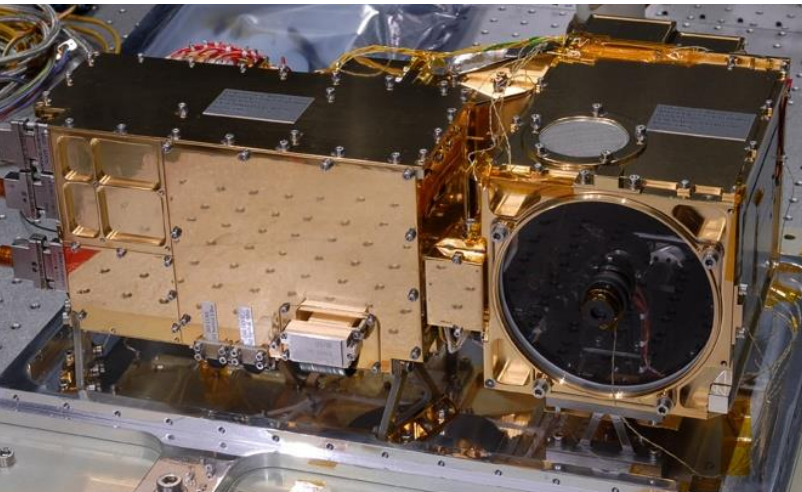
Backup slides



Ground Station

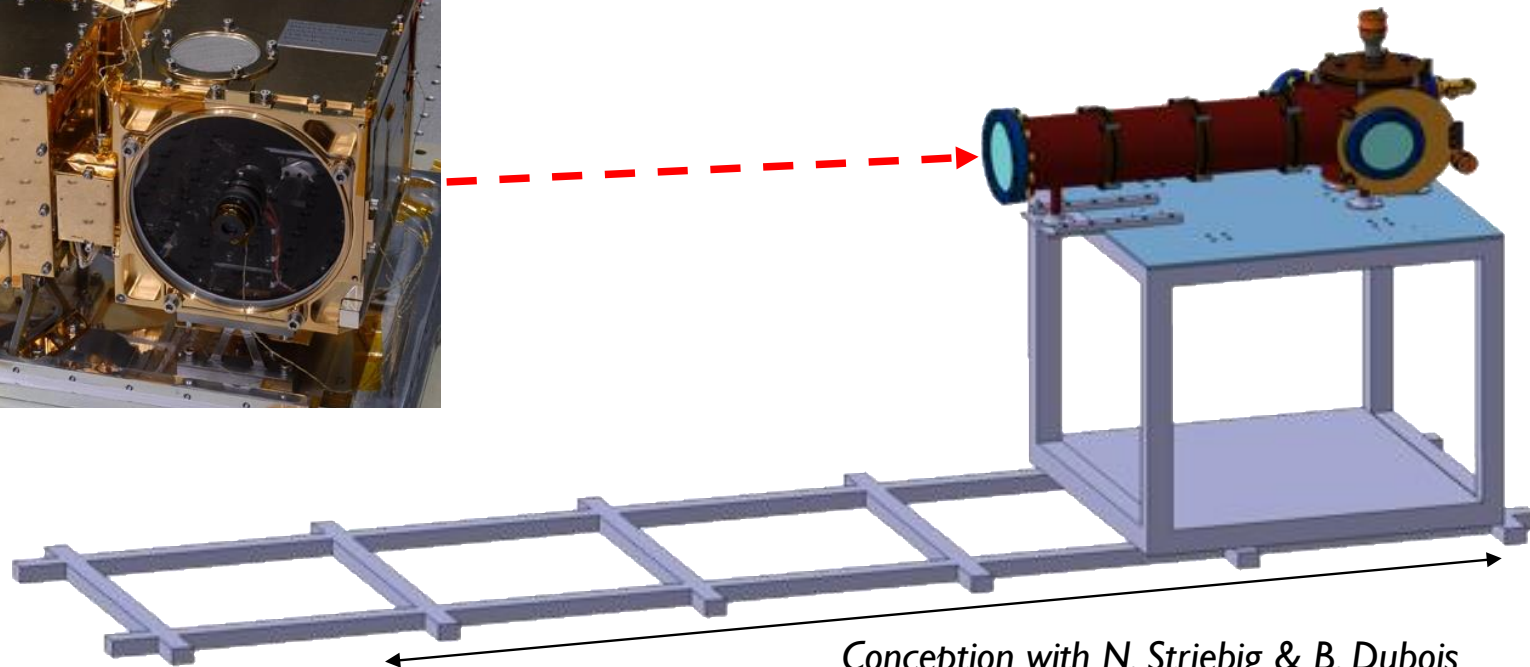
ChemCam

- Mast Unit : Engineering & Qualification Model (EQM)
- Body Unit: Commercial spectrometers (same resolution as flight Model)



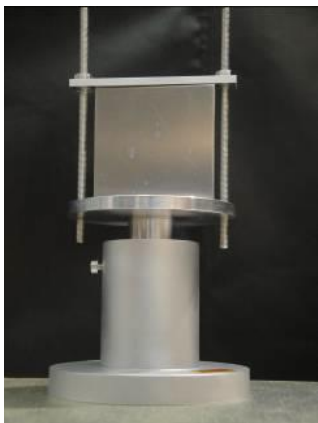
Mars

- 6 mbars
- Mars atmosphere (95.7 % CO₂, 2.7 % N₂, 1.6 % Ar)



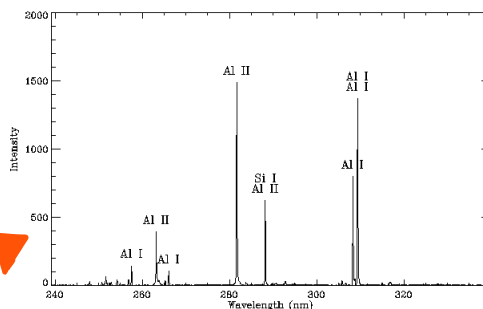
Emission Lines Database Creation

Characterized
sampled

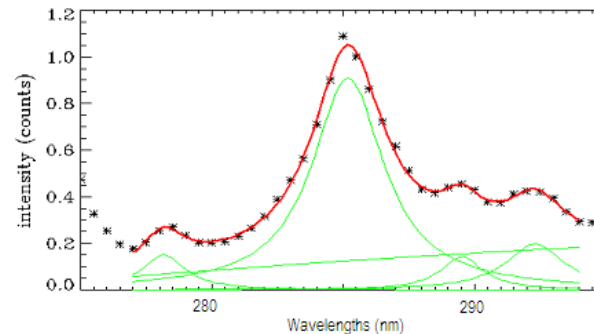


Processing

Line identification with NIST



Line fitting



Database creation

| Element | Ext | OBS. Wave | OBS. Int. | Env. | Target |
|---------|-----|-----------|-----------|------|----------|
| Al | I | 257.570 | 143.582 | MARS | Al/Si |
| Sr | II | 421.682 | 327.219 | MARS | Calib. |
| F | II | 402.578 | 66.9510 | MARS | Fluorine |

| <i>Type of target</i> | Pure targets | Geological targets | Specific Atmospheres |
|------------------------------------|---|---|-----------------------------|
| <i>Elements (Increasing Z)</i> | C, Al, Si, Ti, Mn, Fe, Ni, Cu, Pb | H, Li, Be, B, F, Na, Mg, P, S, Cl, K, Ca, V, Cr, Zn, As, Rb, Sr, Cs, Ba | N, Ar O |

32 elements, 1336 emission lines