Practical Tools for Astronomical Spectroscopy

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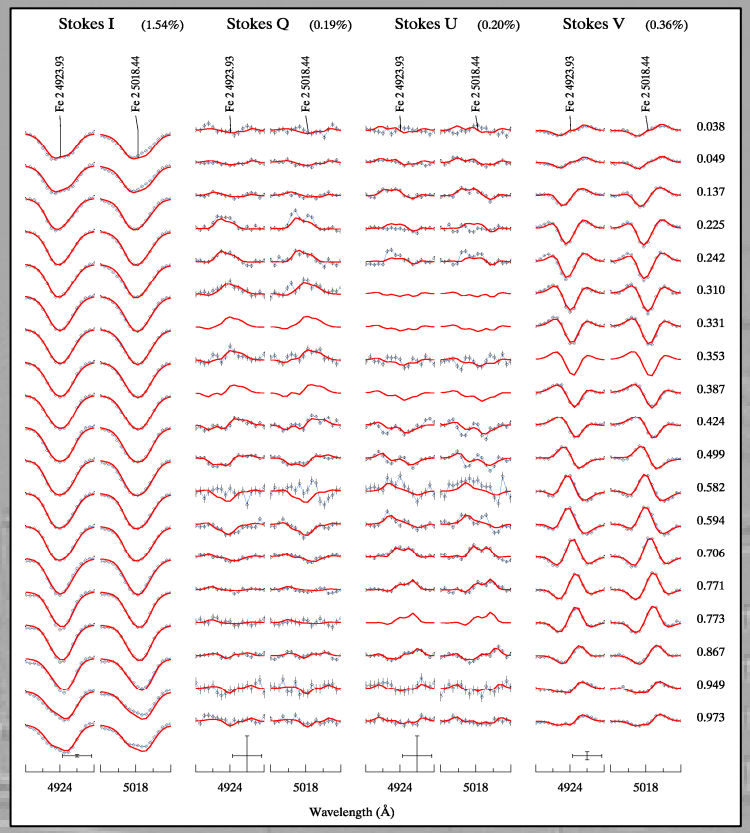
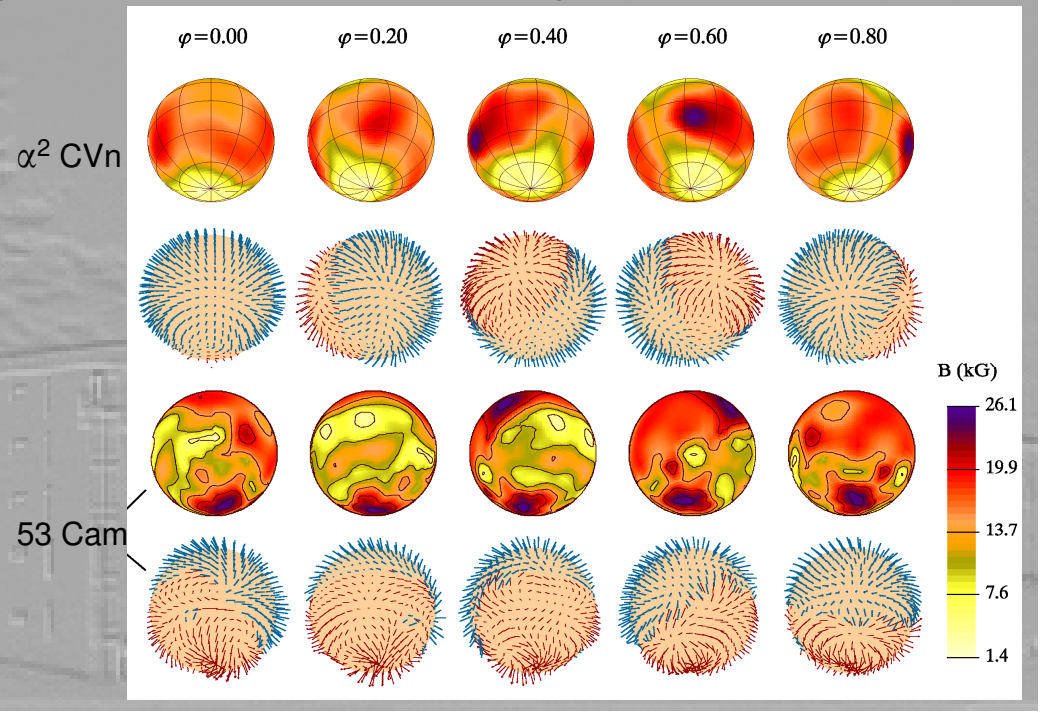




Spectroscopy Made Easy

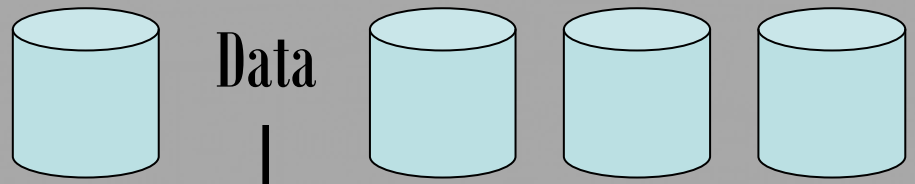
- Solves molecular-ionization equilibrium
  Range of temperature 50 ÷ 350000 K and
  pressure 10^{-14} ÷ 10^{4} bar
  Includes partition functions for 67 atoms with up to 6 ionization stages and for >300 molecules
- Solves radiative transfer through a stellar atmosphere model
  Feautrier + disk integration
- Interpolates atmosphere models
- Fits the various parameters
  T_{eff}, logg, chemical composition, radial velocity, rotation etc.

SME needs …

- Grids of stellar atmosphere models (*built-in:* ATLAS, MARCS, Phoenix)
- Atomic/molecular data (*external:* VALD)

Vienna Atomic Line Database

Nearly 50 million transitions from 100 Å to 200 μ



Data

Pipeline 1

PRESELECT

SELECT

Pipeline 2

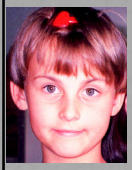
PRESELECT

PRESFORMAT

Pipeline 3

SHOWLINE

VALD clients



VALD 2.3

Pipelines can be configured in over 2000 different ways

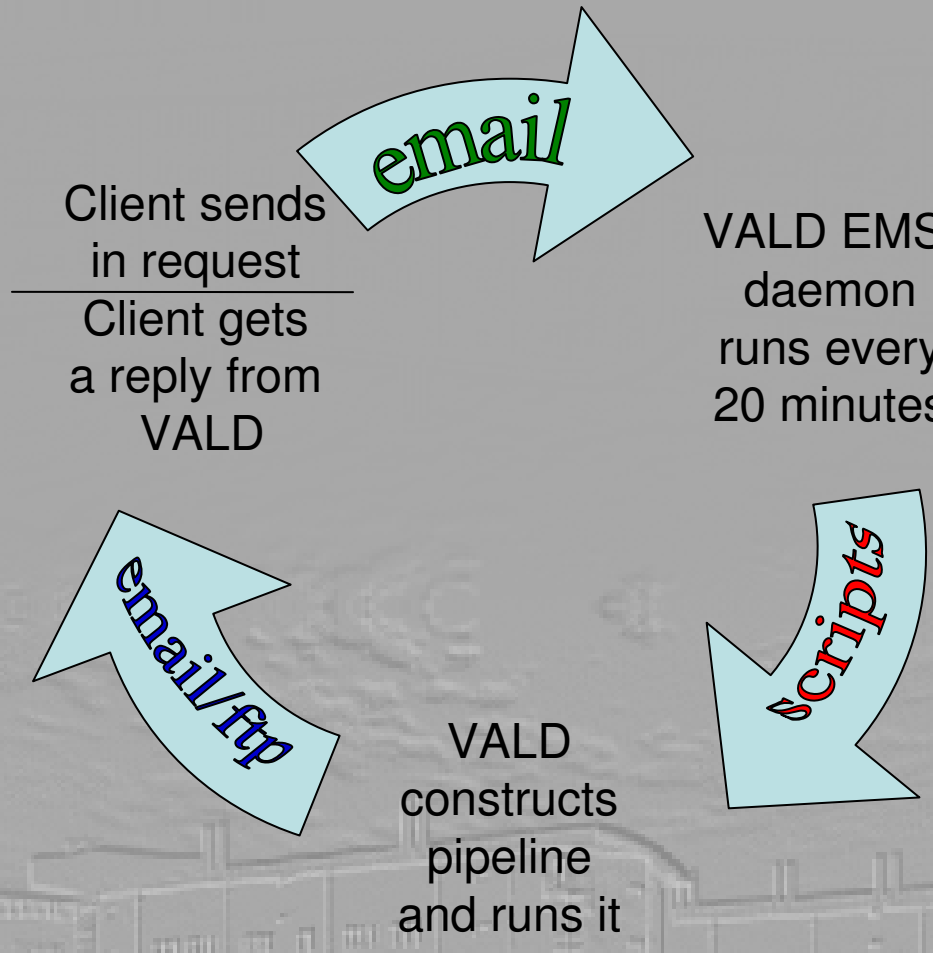
What is in VALD?

For each transition we have:

- Wavelength (lab or comp)
- Oscillator strength
- Excitation energies
- Statistical weights
- Landé factors
- Damping constants (rad, Stark, van der Waals)
- Term designations
- Accuracy of oscillator strength
- Source of data
- Accuracy of wavelength (when available)
- Pointers to HFS
- Isotopic shifts
- Additional comments
- Molecular line data
- Molecular opacity tables

VALD 3

VALD E-Mail Service



VALD mirrors

- Vienna
- Uppsala
- Moscow
- Potsdam
- Baltimore

- Synchronization one every 12 hours
- Processing few hundred requests per day
- Nearly 1000 clients from 68 countries!
- ***See VALD poster #18 for more details!***

Typical request

begin request
extract stellar
default configuration
short format
Have Waals
5700, 5703
0.08, 2
8000, 4.5
Sr: -4.67, Cr: -3.37, # Setup specific chemical composition
end request

```
5700.0, 5703.0, 5, 76, 2.0, Wavelength region, lines selected, lines processed, Vmicro
                                        Damping parameters  Lande Central
Elm Ion   WL(A)  Excit(eV) Vmic log(gf)  Rad.  Stark  Waals factor  depth    Reference
'Cr 1', 5700.5500, 3.4490, 2.0, -2.574, 7.812,-6.185,-7.822, 1.120, 0.204, '1 1 1 1 1 1 1‘
'S  1', 5700.5800, 7.8680, 2.0, -1.040, 0.000, 0.000, 0.000,99.000, 0.094, '2 2 2 2 2 2 2‘
'Si 1', 5701.1040, 4.9300, 2.0, -2.050, 8.310,-4.410, 0.000,99.000, 0.088, '3 3 3 3 3 3 3‘
'Cr 2', 5701.4640, 3.8270, 2.0, -3.845, 8.677,-6.611,-7.929, 0.960, 0.635, '1 1 1 1 1 1 1‘
'Fe 1', 5701.5450, 2.5590, 2.0, -2.216, 8.167,-6.052,-7.840, 1.100, 0.241, '4 4 4 5 5 5 5‘
'08000G45.KRZ',
'H : 0.91','He: -1.05', … ,'Es:-20.00','END‘
References:
1. GFIRON obs. energy level: Cr
2. Bell light: Si to K
3. NLTE lines: Si
4. FeI NMT Whaling and Bard & Kock
5. GFIRON obs. energy level: Fe
```

Next step: VALD 3

- Molecules (the same solver as in SME)
- New improved datasets for atoms
- New software including synchronization of datasets
- Possibly on-line spectral synthesis
- New VALD web interface

Which tools belong to VO and which do not?

What do you think?