AOMIC SPECTRAL LINE BROADNING AND DATABASES FOR STELLAR PLASMA RESEARC

- MILAN S. DIMITRIJEVIĆ

Outline

1.Needs for large line broadening dana set
2. Virtual Observatories and Astroinformatics
3. Databases for Spectral Line Shapes
4. Virtual Atomic and Molecular Data Center

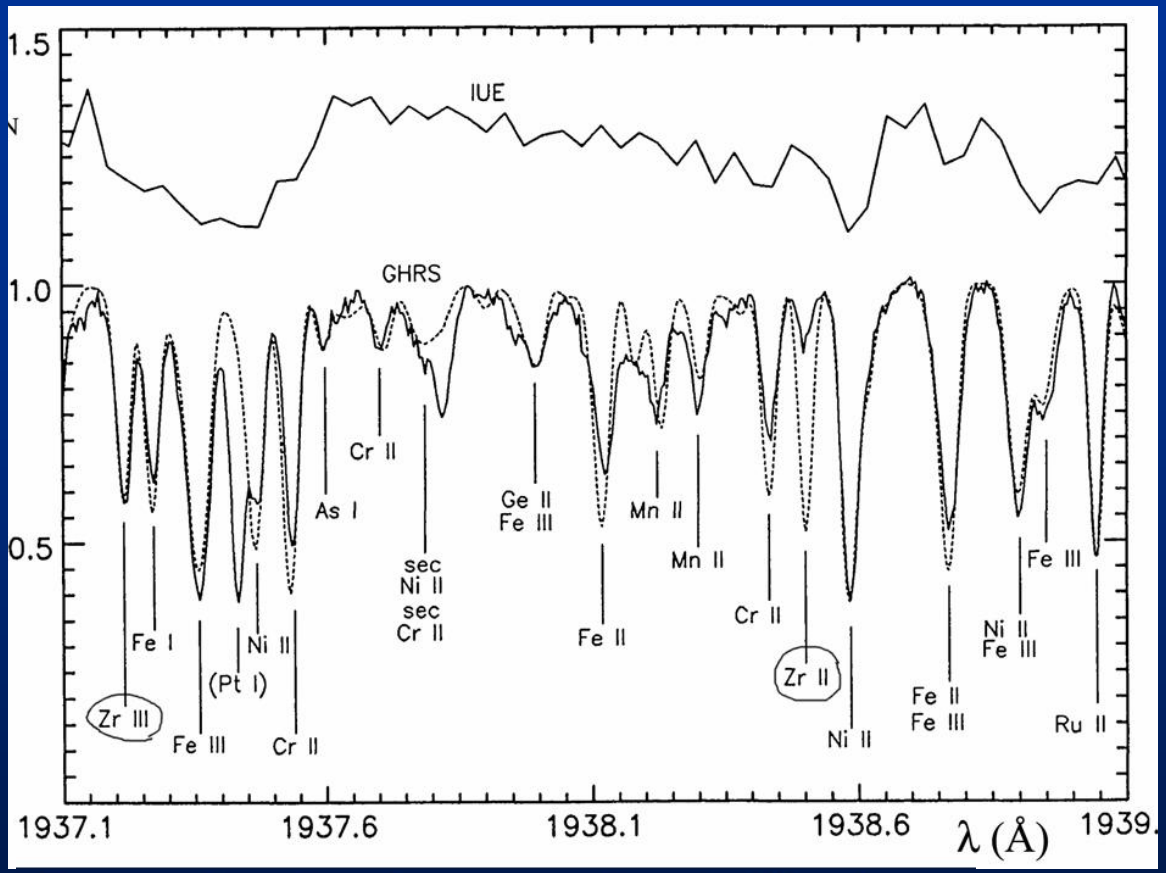
1. NEEDS FOR LARGE STARK BROADENING DATA SET

- DEVELOPMENT OF COMPUTERS

  FOR EXAMPLE:

  PHOENIX CODE FOR MODELLING OF STELLAR ATMOSPHERES INCLUDES A PERMANENTLY GROWING DATABASA WITH ATOMIC DATA FOR MORE THAN 500 MILLIONS TRANSITIONS

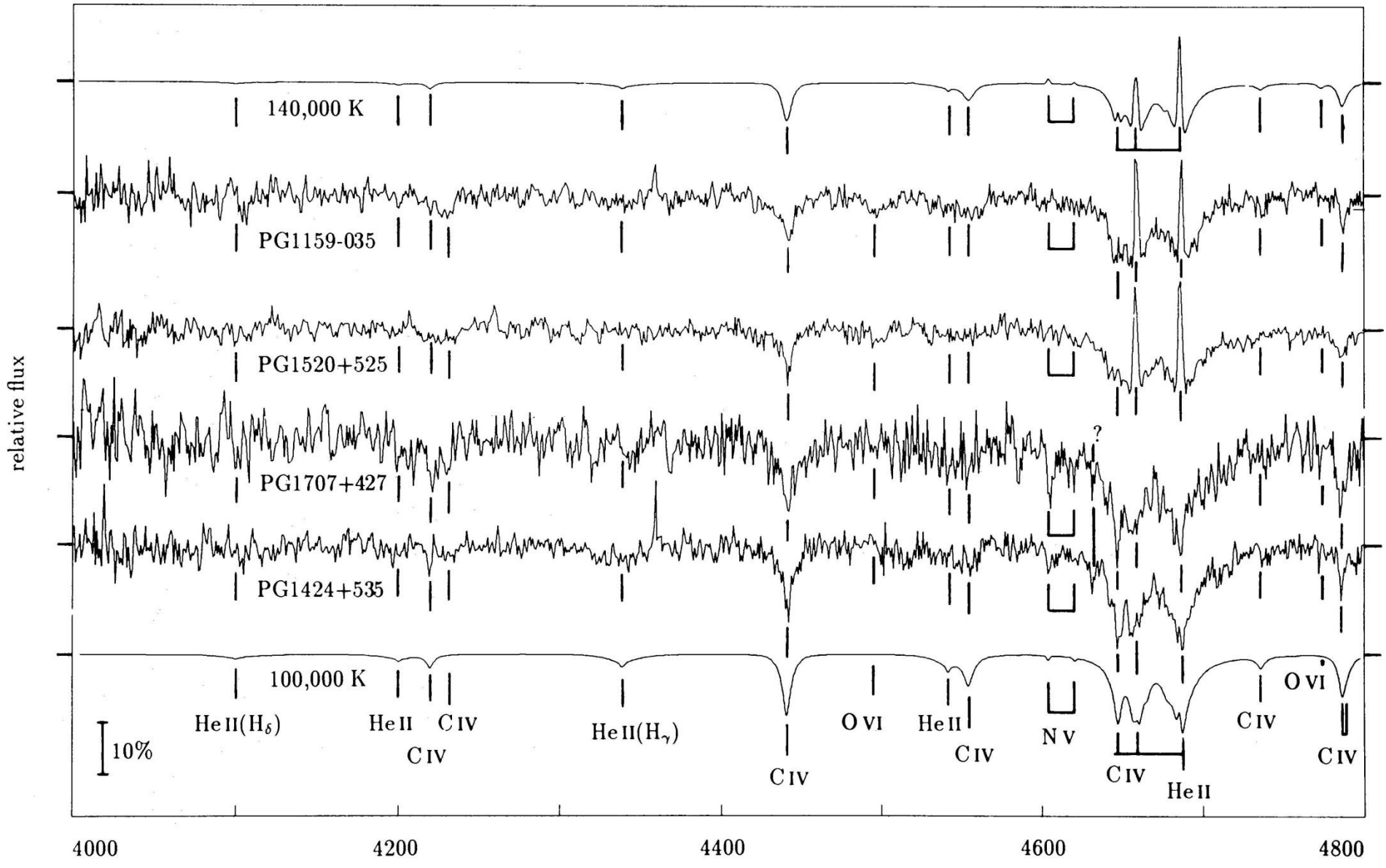
- SATELLITE BORNE SPECTROSCOPY



Example of advance of satellite born spectroscopy

Part of Chi Lupi spectrum obtained with International Ultraviolet explorer (IUE) and with Godhard High Resolution Spectrograph on Hubble telescope (GHRS). One can see how lines of trace elements become more and more important.

K. Werner, U. Heber, K. Hunger, 1991, A&A, 244, 437



Example of importance of Stark broadening in Ap stars

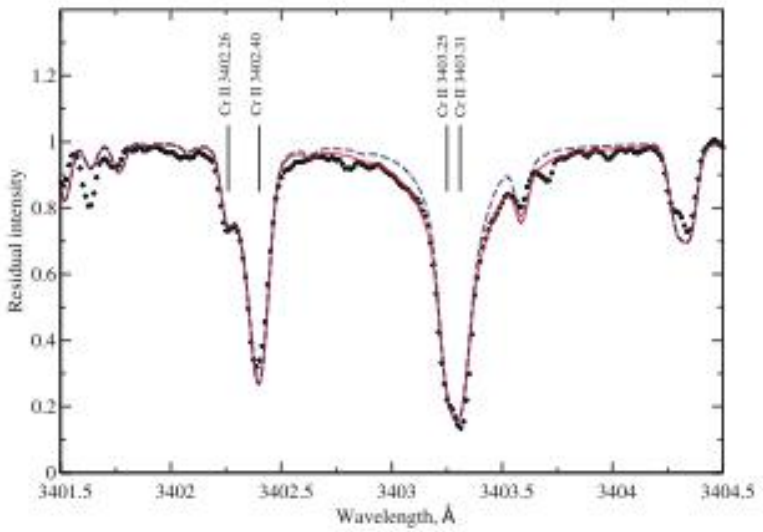


Fig. 4. Comparison between the observed Cr II 3403.30 line profile (dots) and synthetic calculations with the Stark parameters from present paper (full red line) and those from Kurucz (1993) (blue dashed line).

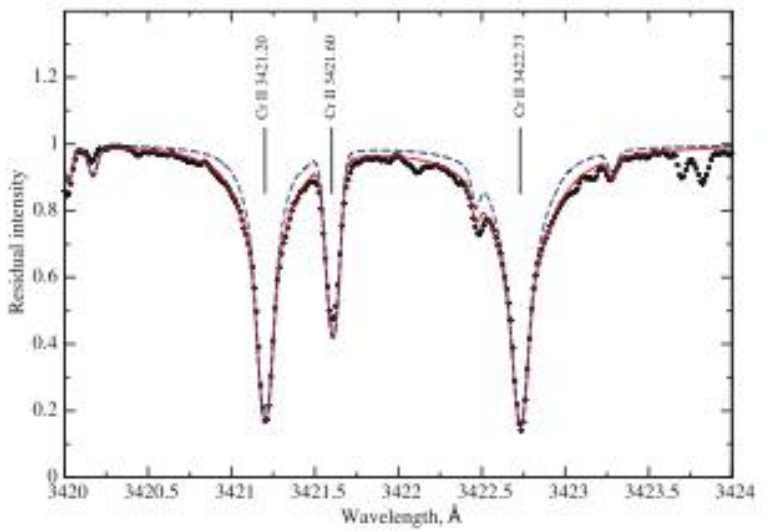


Fig. 6. The same as in Fig. 4 but for the Cr II 3421.20, 3422.73 lines.

INFORMATION AVALANCHE

HUGE DATA COLLECTIONS

Sloan Digital Sky Survay SDSS,

Spectra of ~ 230 million objects

Images 16 Terabytes - to download with 10Mb/s ~5 Months

Catalogues 18 Terabytes – to download ~6m

HUGE SURVAYS

8.4m LSST Telescope 30 Terabytes per night

Petabyte order data collection

2. VIRTUAL OBSERVATORIES AND ASTROINFORMATICS

Success of IUE and HST archives

Idea of VirtualObservatory end 2000

2001-2005 FP5 Project ASTROPHYSICAL VIRTUAL OBSERVATORY – AVO →EUROPEAN VIRTUAL OBSERVATORY-EURO-VO

http://www.euro-vo.org

IVOA 2002

VIRTUAL OBSERVATORY

VO: ALL ASTRONOMICAL DATABASES IN YOUR PC → DEMOCRATIZATION OF SCIENCE

THIS REQUIRES THAT ALL PLAYERS SPEAK THE SAME LANGUAGE

VO STANDARDS AND PROTOCOLS DEFINED AND ADOPTED WITHIN IVOA

ASTROINFORMATICS

e-SCIENCE IN ASTRONOMY

e-Science → New way to do science – use of huge distributed data reservoirs

FOURTH PARADIGM OF SCIENCE

-observations

-theory

-experiment

ASTROINFORMATICS

e-SCIENCE IN ASTRONOMY

e-Science → New way to do science – use of huge distributed data reservoirs

FOURTH PARADIGM OF SCIENCE

-observations

-theory

-experiment

-DATA MINING – KNOWLEDGE DISCOVERY

3. DATABASES FOR SPECTRAL LINE SHAPES

1. Atomic Spectral Line Broadening Bibliographical Database – NIST
2. VALD Vienna Atomic Lines Database
3. BALSS – Bibliography on Atomic Line Shapes and Shifts
4. Griem's Tables
5. STARK-B

ersion History - Disclaimer

Atomic Spectral Line Broadening Bibliographic Database

A. Kramida and J.R. Fuhr,
National Institute of Standards and Technology, Physical Measurement Laboratory, Quantum Measurement Division

Welcome to NIST's bibliographic database on atomic spectral line broadening, Version 3.0.
The database currently contains 6908 references, dating from 1889 through 2017 and is updated regularly.

Display Search Form

This database contains references to publications that include numerical data, general information, comments, and reviews on atomic line broadening and shifts, and is part of the collection of the **NIST Atomic Spectroscopy Data Center**. This Data Center also maintains another two bibliographic databases:
NIST Atomic Transition Probability Bibliographic Database and
NIST Atomic Energy Levels and Spectra Bibliographic Database.
References to publications containing critically compiled data can be found in a separate database of
NIST compilations of atomic spectroscopy data.

For help or more information, contact A. Kramida.

This database was funded [in part] by NIST's Standard Reference Data Program (SRDP) and by NIST's Systems Integration for Manufacturing Applications (SIMA) Program.

Search for Publications on Atomic Line Broadening and Shifts

The database presently contains 6908 references dating from 1889 to 2017. Last updated on February 14, 2017.

Spectra: e.g., Fe I, or Na, or Mg+, or Al3+, or mg iv,vi-VIII, or Fe ne-like-S-like, or Ne-Fe I-III, or S-, or D I, or 7Li I

Word/Pattern in title:

Author(s):

Publication Year: From To

Publication Source:

JOURNALS
COLLECTIONS
BOOKS
REPORTS
THESES
- 2016 Int. Conf. Laser Optics
- Acta Astrophys. Sinica
- Acta Cient. Venezolana
- Acta Crystallogr.
- Acta Crystallogr., Sect. A

Method type

- Experiment
- Theory
- Both
- Comment
- Compilation

Mechanism

Natural
Doppler
Zeeman
Pressure
- Resonance
- Stark
- van der Waals by:
  - Al

Combine mechanisms by
- OR
- AND

General Interest Category

General Articles on Line Shapes and Shifts
PRESSURE BROADENING...
- Stark broadening and shifts...
  - Hydrogen and hydrogen-like (overlapping) lines
  - Isolated lines of neutral spectra
  - Isolated lines of ionic spectra
  - Topics of particular interest...
    - Line wings

Sort by: published year, first author's last name.

Search for References | Clear Form

For help or more information, contact A. E. Kramida.

This database was funded [in part] by NIST's Standard Reference Data Program (SRDP) and by NIST's Systems Integration for Manufacturing Applications (SIMA) Program.

Server: Uppsala VALD3

Version: 1775M

Welcome to VALD3

Please enter your registered email address :

Login Reset

Documentation

- About VALD
- Documentation
- News

VALD3 Mirror Servers

- VALD3 Mirror Uppsala
- VALD3 Mirror Vienna
- VALD3 Mirror Moscow

Contact / Registration

- Contact form

Contact form

If you would like to **register as a new user**, or for any other reason would like to **contact one of the managers of VALD**, please complete the form below.

When registering, please provide the following information:

1. The email address at which you would like to receive the results of your VALD database queries
2. Your full name and affiliation

If you intend to access VALD-EMS from different computers, send **all** e-mail addresses that you intend to use. Note that the address actually extracted from an e-mail to VALD is provided through the very first line of the envelope/header of an e-mail.

Your email :

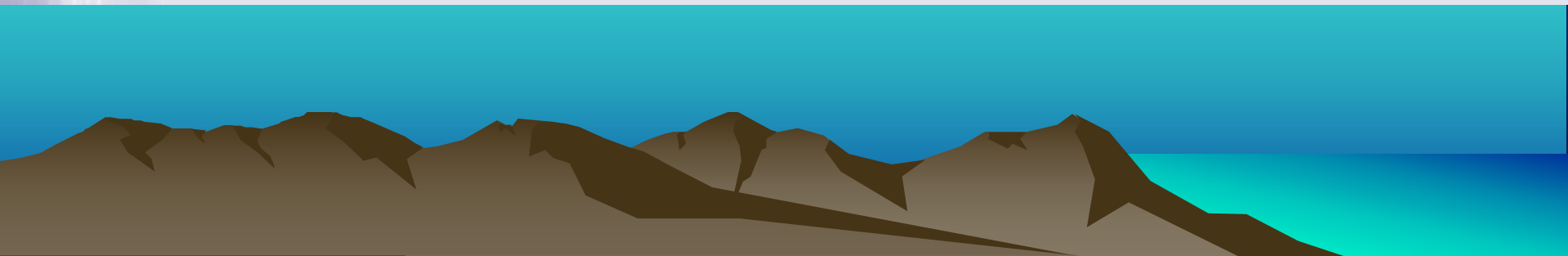
Full name : (required for registration)

Affiliation : (required for registration)

To : VALD Administrator

Your message :

Send message Clear



l'Observatoire de Paris

- Homepage
- Presentation
- VUV Spectra of Small Molecules
- VUV Spectra of Atomic Ions
- Radiative and Collisional Data for X-Ray Spectra
- Spectral Line Shapes
- Crovisier's Compilation of Molecular Data
- Other DataBases of Interest

Webmaster - Contact

l'Observatoire de Paris

MOLAT
Atomic and Molecular Data

Contributing Paris Observatory laboratories :

GEPI *Galaxies, Etoiles, Physique et Instrumentation*
LERMA *Laboratoire d'Étude du Rayonnement et de la matière en Astrophysique*
LESIA *Laboratoire d'Études Spatiales et d'Instrumentation en Astrophysique*
LUTH *Laboratoire Univers et Théories*

Supported by the CNRS programs :

PCMI *Physique et Chimie du Milieu Interstellaire*
PNPS *Programme National de Physique Stellaire*
PNST *Programme National Soleil-Terre*

l'Observatoire de Paris

Homepage
Presentation
VUV Spectra of Small Molecules
VUV Spectra of Atomic Ions
Radiative and Collisional Data for X-Ray Spectra
Spectral Line Shapes
Crovisier's Compilation of Molecular Data
Other DataBases of Interest

Webmaster - Contact

Spectral Line Shapes

BALSS

- Bibliography on Atomic Line Shapes and Shifts (formerly named STARK)

Griem's Tables

- Stark broadening parameters for neutrals and singly charged ions

Stark-b

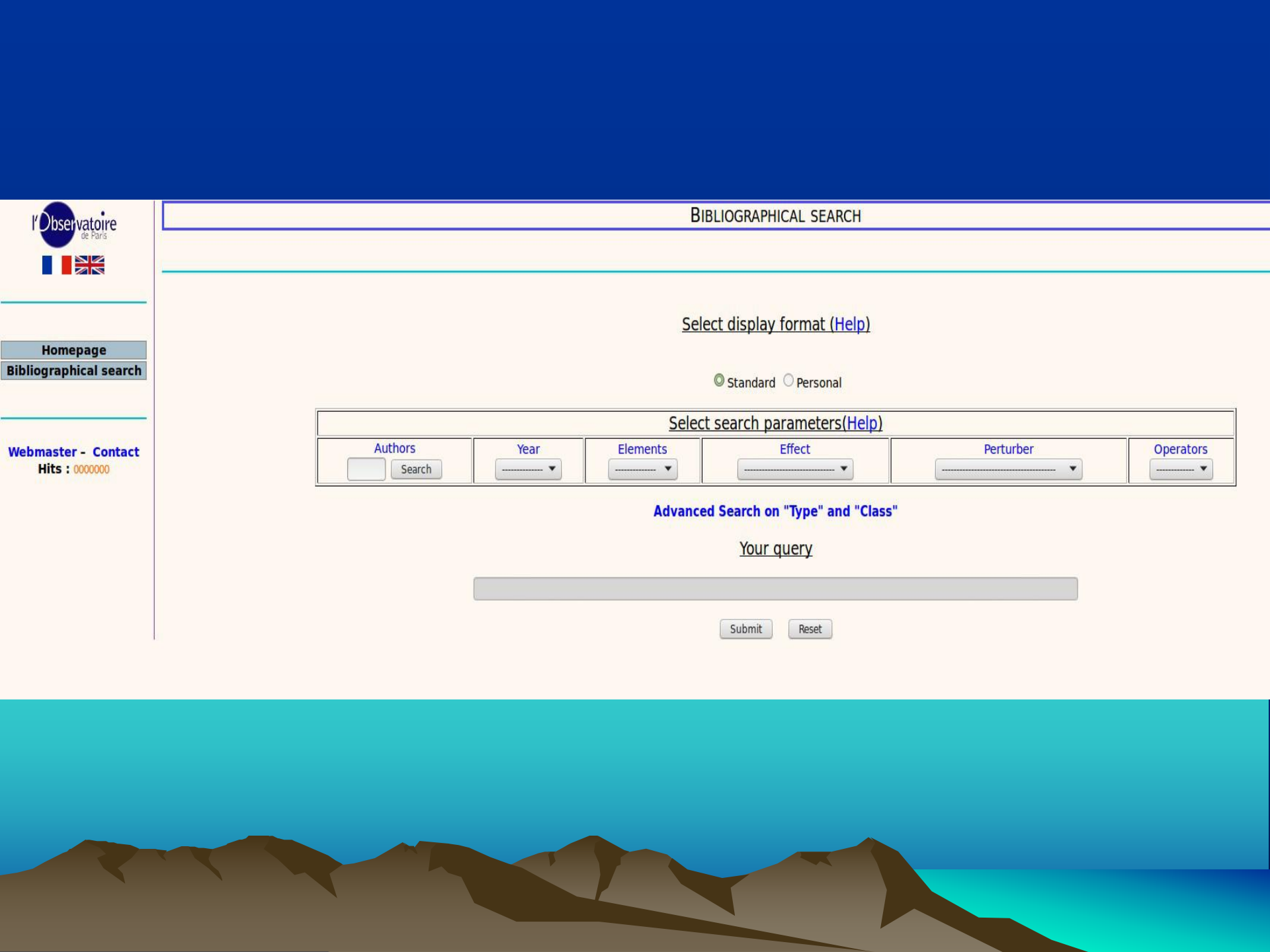
- Database for "Stark" broadening of isolated lines of atoms and ions in the impact approximation

Last update : 06/10/2008

BALSS
Bibliography on Atomic Line Shapes and Shifts

Computerized version of the Bibliography on Atomic Line Shapes and Shifts (BALSS) by J.R. Fuhr and A. Lesage. References of articles about Stark, Doppler, Van der Waals, resonance, natural and instrumental broadering and associed topics.

Last Update : 09/08/2007


l'Observatoire de Paris
Homepage
Bibliographical search
Webmaster - Contact
Hits : 0000000
BIBLIOGRAPHICAL SEARCH
Select display format (Help)
Standard
Personal
Select search parameters(Help)
Authors
Search
Year
Elements
Effect
Perturber
Operators
Advanced Search on "Type" and "Class"
Your query
Submit
Reset

STARK BROADENING PARAMETERS FOR NEUTRAL AND SINGLY CHARGED IONS :

HELIUM THROUGH CALCIUM, AND CESIUM

Choose element

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															
			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	

*Griem, H. R., "Spectral Line Broadening by Plasmas" (Academic Press, New York, 1974)©.

STARK-B

Database for "Stark" broadening of isolated lines of atoms and ions in the impact approximation

http://stark-b.obspm.fr

- **Calculated widths and shifts:** more than 150 pubs (*1984-2017)*

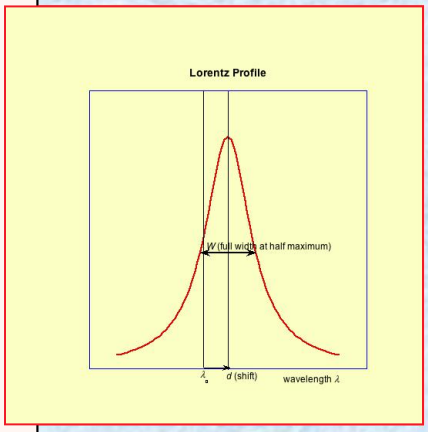
- **SCP theory updated** and **operated** by S. Sahal-Bréchot, M.S. Dimitrijević and colleagues

- STARK B is currently developed at Paris Observatory
  - *the database has been opened since September 2008:*
  - It is a part of the atomic and molecular databases of the Paris Observatory
- Link to SerVO - Serbian Virtual Observatory

http//:servo.aob.rs

- It is node of VAMDC- Virtual Atomic and Molecular Data Centre
- it follows the standards of VAMDC and Virtual Observatories

(Europe: IVOA *International Virtual Observatory Alliance*)

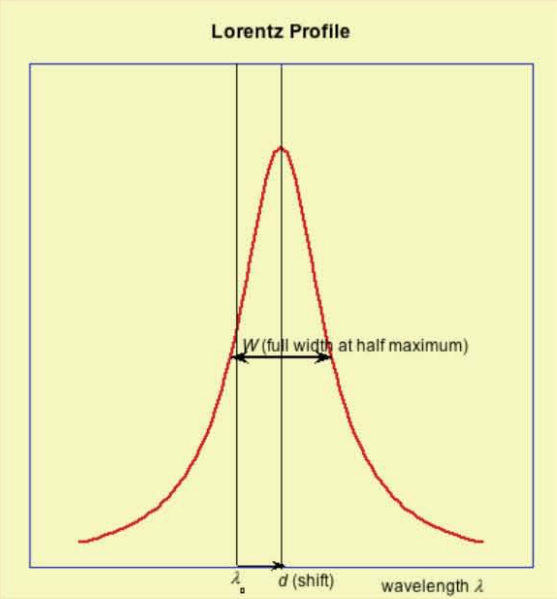


STARK-B http://stark-b.obspm.fr

HOMEPAGE | INTRODUCTION | DATA DESCRIPTION | ACCESS TO THE DATA | UPDATES | CONTACT

STARK-B

Database for "Stark" broadening of isolated lines of atoms and ions in the impact approximation



The STARK-B database is now fully opened though not yet complete.

Last data update : 2012-03-30

MOLAT | l'Observatoire de Paris | Astronomical Observatory, Belgrade

Introduction

STARK-B is a database of calculated widths and shifts of isolated lines of atoms and ions due to electron and ion collisions.

This database is devoted to modeling and spectroscopic diagnostics of stellar atmospheres and envelopes. In addition, it is also devoted to laboratory plasmas, laser equipments and technological plasmas. So, the domain of temperatures and densities covered by the tables is wide and depends on the ionization degree of the considered ion. The temperature can vary from several thousands for neutral atoms to several hundred thousands of Kelvin for highly charged ions. The electron or ion density can vary from 10^{12} (case of stellar atmospheres) to several $10^{19}cm^{-3}$ (some white dwarfs and some laboratory plasmas).

The impact approximation and the isolated line approximation are applied, so that the line profile is Lorentzian. The basis for calculations is the computer code which evaluates electron and ion impact broadening of isolated spectral lines of neutral atoms and ions, using the semiclassical-perturbation approach developed by Sahal-Bréchot (1969ab, 1974), and supplemented in Fleurier et al. (1977), see below. This computer code has been updated by Dimitrijević and Sahal-Bréchot in their series of papers, Dimitrijević and Sahal-Bréchot (1984) and following papers. The data are derived from this series of papers and are cited in the tables. The accuracy of the data varies from about 15-20 percent to 35 percent, depending on the degree of excitation of the upper level, and on the quality of the used atomic structure entering the calculation of scattering S-matrix leading to the widths and shifts. The more the upper level is excited, the more the accuracy is good. In the earlier papers, the used atomic structure was the so-called “Bates and Damgaard” one (Coulomb wavefunctions + quantum defect). More recent atomic structure data are introduced in the latest papers. Fore more details, the reader is invited to refer to the papers cited in the tables for the used atomic data and atomic levels.

The impact approximation

The impact approximation is valid when the mean duration τ of a collision is much smaller than the mean interval ΔT between two collisions (Baranger 1958 abc). ΔT is of the order of the inverse of the colisional line width γ expressed in angular frequency units.
τ can be written as :
$\tau = \langle\rho\rangle / \langle v\rangle$,
where <ρ> is a typical impact parameter and <v> the mean velocity of the collider :

Periodic table of elements

Click on a yellow case corresponding to the chosen element and then on an ionization degree. There are no data on the non-coloured cases. Then a new page appears, requiring your detailed choice.

Line widths and shifts table

Column 1

Perturber density N in cm^{-3}

Column 2

Lower level or lower term

Column 3

Upper level or upper term

Comments to columns 2 and 3

When the fine structure splitting is small, namely if the difference between energy levels of the same multiplet is small compared to the distance to the next level linked by an allowed transition, all the fine structure lines of the same multiplet have the same width and shift. In that case the data are given for the multiplet only and for an average wavelength for the whole multiplet. If needed, the width value for a particular line within a multiplet can be obtained from :

$W_{line} = W_{mult}\ I2_{line} / \lambda^2_{mult}$

Idem for the shift

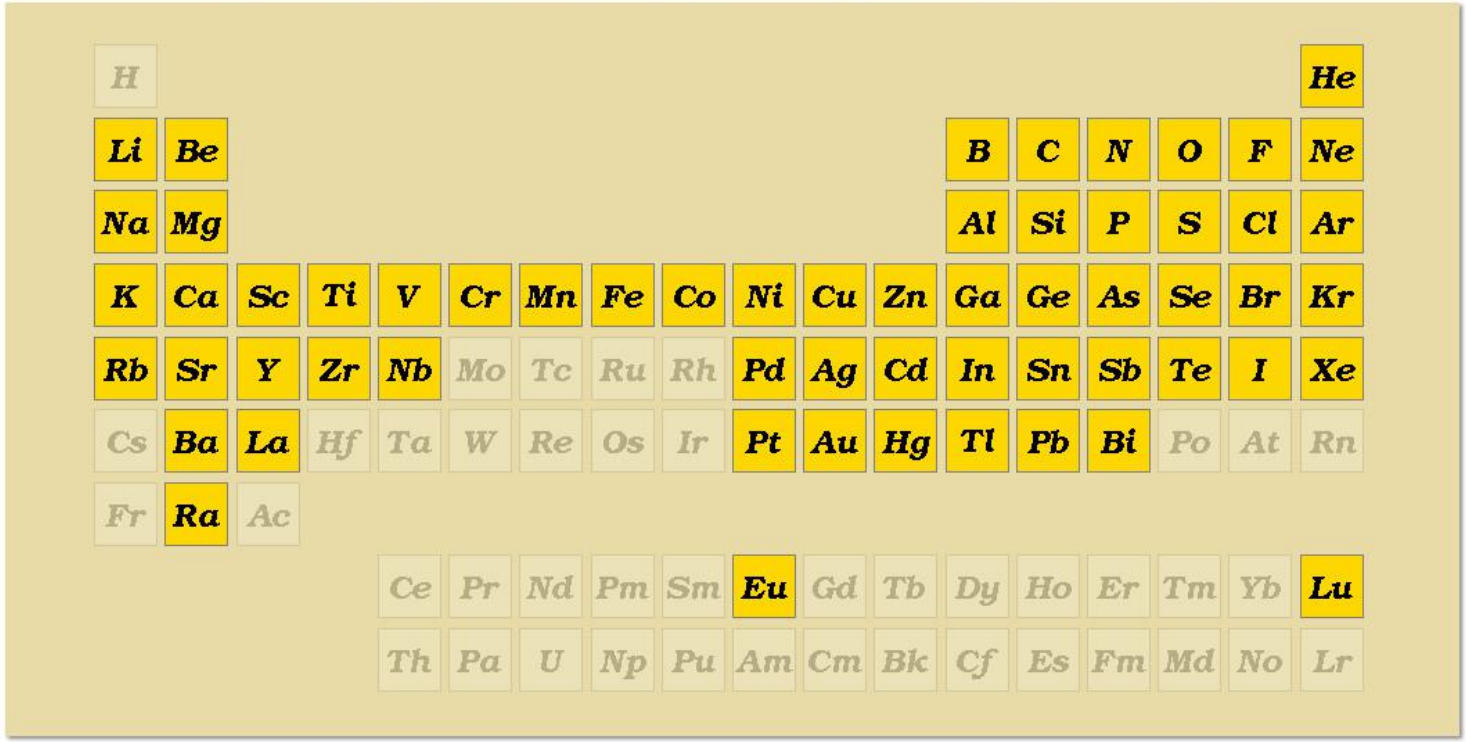
Column 4

Stark-b - Mozilla Firefox

(17) AOB Webmail :: Inbox | XI BULGARIAN-SERBIAN AS | Stark-b

stark-b.obspm.fr/index.php/table

Home Introduction Data description Access to the data Data history Contact



Menu | Belogradchik ... | [files] | Stark-b - Mozil... | Wicd Network ... | KINGSTON | Dimitrijevic-SL... | 2.7 k | sr | 15 °C | Tue May 15, 05:45

Ionization degree of the element

Si I Si IV Si V Si VI Si XI Si XII Si XIII

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															
			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	

Choose an element and a ionization degree

- Si I
- Si IV
- Si V
- Si VI
- Si XI
- Si XII
- Si XIII

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															
				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

MOLAT

l'Observatoire de Paris

Astronomical Observatory, Belgrade

Si IV. electron Hydrogen II Helium II . me

1.00e+17

or enter a value: OK

All

or a wavelength interval

min (Å): max (Å): OK

All

Citation

When using these data, please refer to the original papers and to this database as :

Sahal-Bréchot, S., Dimitrijević, M.S., Moreau N., 2018. STARK-B database, [online].

http://stark-b.obspm.fr [May 15, 2018]. Observatory of Paris, LERMA and Astronomical Observatory of Belgrade

References

- Dimitrijević M.S., Sahal-Bréchot S., Bommier V.

References

- Dimitrijević M.S., Sahal-Bréchot S., Bommier V.

  Stark broadening of spectral lines of multicharged ions of astrophysical interest. II: Si IV lines., A&AS, Vol.89, p.591-598, 1991

  ADS link : http://cdsads.u-strasbg.fr/abs/1991A%26AS...89..591D

- Dimitrijević M.S., Sahal-Bréchot S., Bommier V.

  Stark broadening parameters tables for spectral lines of multicharged ions of astrophysical interest. II: Si IV lines, Bull. Obs. Astron. Belgrade, Vol.144, p.81-99, 1991

  ADS link : http://cdsads.u-strasbg.fr/abs/1991BOBeo.144...81D

Line widths and shifts (hide table)

Export as Text | Export as VOTable

N (CM-3)	LOWER LEVEL	UPPER LEVEL	MULTIPLET	WAVELENGTH (Å)	C (Å/CM-3)	T (K)	A	*V
1.000e+17	2p6.3d 2D	2p6.4f 2Fo	28	1066.6	4.700e+18	20000		
1.000e+17	2p6.3d 2D	2p6.4f 2Fo	28	1066.6	4.700e+18	50000		
1.000e+17	2p6.3d 2D	2p6.4f 2Fo	28	1066.6	4.700e+18	80000		
1.000e+17	2p6.3d 2D	2p6.4f 2Fo	28	1066.6	4.700e+18	100000		
1.000e+17	2p6.3d 2D	2p6.4f 2Fo	28	1066.6	4.700e+18	150000		

References

- Dimitrijević M.S., Sahal-Bréchot S., Bommier V.

  Stark broadening of spectral lines of multicharged ions of astrophysical interest. II: Si IV lines., A&AS, Vol.89, p.591-598, 1991

  ADS link : http://cdsads.u-strasbg.fr/abs/1991A%26AS...89..591D

- Dimitrijević M.S., Sahal-Bréchot S., Bommier V.

  Stark broadening parameters tables for spectral lines of multicharged ions of astrophysical interest. II: Si IV lines, Bull. Obs. Astron. Belgrade, Vol.144, p.81-99, 1991

  ADS link : http://cdsads.u-strasbg.fr/abs/1991BOBeo.144...81D

Line widths and shifts (hide table)

Export as Text | Export as VOTable

	ELECTRON				HYDROGEN II				HELIUM II			
A	*W	W (Å)	*D	D (Å)	*W	W (Å)	*D	D (Å)	*W	W (Å)	*D	D (Å)
		2.880e-2		-8.210e-4		5.780e-4		-8.390e-4		7.660e-4		-7.740e-4
		1.950e-2		-5.990e-4		1.360e-3		-1.490e-3		1.450e-3		-1.280e-3
		1.620e-2		-6.360e-4		1.870e-3		-1.810e-3		1.750e-3		-1.480e-3
		1.500e-2		-5.870e-4		2.030e-3		-1.900e-3		1.890e-3		-1.590e-3
		1.310e-2		-4.350e-4		2.340e-3		-2.130e-3		2.120e-3		-1.770e-3

Fitting coefficients (hide table)

Export as Text | Export as VOTable

How to use

Below are the equations used to get the fitted data :

- log(w)=a_0 + a_1 log(T) + a_2 (log(T))^2
- d/w = b_0 + b_1 log(T) + b_2 (log(T))^2

N.B : This fitting must only be used inside a temperature interval where widths and/or shifts are provided.

Reference : S. Sahal-Bréchot, M. S. Dimitrijević , N. Ben Nessib , "Comparisons and comments on electron and ion impact profiles of spectral lines", 2011, Baltic Astronomy, Vol. 20, pp. 523-530

						ELECTRON					
N (CM-3)	LOWER LEVEL	UPPER LEVEL	MULTIPLET	WAVELENGTH (Å)	C (Å/CM-3)	A0	A1	A2	B0	B1	B2
1.000e+17	2p6.3d 2D	2p6.4f 2Fo	28	1066.6	4.700e+18	1.96024	-1.16514	0.08167	0.50976	-0.22163	0.02
1.000e+17	2p6.3d 2D	2p6.4p 2Po	26	1724.1	7.300e+19	2.76465	-1.36555	0.10338	-0.09369	0.01001	0.00
1.000e+17	2p6.3d 2D	2p6.5f 2Fo	30	749.9	6.700e+16	0.30818	-0.40722	0.01121	-1.31148	0.51872	-0.05
1.000e+17	2p6.3d 2D	2p6.5p 2Po	29	860.7	8.300e+18	0.94349	-0.83594	0.06179	-0.2415	0.08919	-0.00
1.000e+17	2p6.3d 2D	2p6.6f 2Fo	32	645.8	8.900e+18	2.03468	-1.31584	0.10046	-0.24536	0.10136	-0.01
1.000e+17	2p6.3d 2D	2p6.6p 2Po	31	688.3	2.800e+18	0.76138	-0.77048	0.06172	-0.20216	0.09985	-0.00
1.000e+17	2p6.3p 2Po	2p6.3d 2D	14	1126.4	7.400e+19	1.41813	-1.05063	0.06302	0.08162	-0.03926	0.00

New datasets

ION	PERTURBERS	METHOD	DATE OF IMPORTATION
O III	e	MSE	2017-02-15
Kr II	e	MSE	2017-01-23
Kr III	e	MSE	2017-01-08
Cd II	e	MSE	2016-12-21
Ag II	e	MSE	2016-12-21
F III	e	MSE	2016-12-21
F VI	e	MSE	2016-12-21
Ar II	e	MSE	2016-12-21
Ti II	e	MSE	2016-12-19
V IV	e	MSE	2016-11-29
V II	e	MSE	2016-11-23
Zn II	e	MSE	2016-11-23
V III	e	MSE	2016-11-22
Bi II	e	MSE	2016-09-22
Ti III	e	MSE	2016-09-12

Updated datasets

ION	PERTURBERS	METHOD	INITIAL IMPORT	CURRENT VERSION
Se III	electron	MSE	2016-03-01	2017-01-31
Zr III	electron	MSE	2016-02-05	2016-04-26
Ne VII	electron	MSE	2016-02-29	2016-04-01
Al III	electron proton He II	SCP	2008-09-05	2016-03-24
Ne I	electron proton He II	SCP	2011-02-12	2016-02-24
Ca I	electron proton He II Mg II Si II Fe II	SCP	2012-06-30	2015-11-02
Ca I	electron proton He II	SCP	2012-06-30	2015-11-02
Ca I	electron proton He II Mg II Si II Fe II	SCP	2008-06-18	2015-11-02
Ca I	electron proton He II	SCP	2010-07-20	2015-11-02
Si V	electron	MSE	2014-01-29	2015-10-28
Pb IV	electron proton He II	SCP	2012-03-14	2013-04-29
Kr I	electron proton He II	SCP	2010-04-30	2013-04-13
Cr II	electron proton He II	SCP	2010-04-30	2013-04-13
C II	electron proton He II	SCP	2010-01-27	2013-02-10
Ti XI	electron proton He III	SCP	2008-06-18	2012-08-05

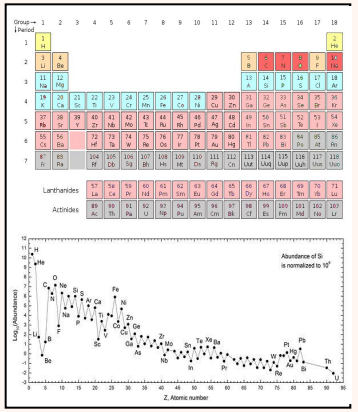
For further enquiries or user support, contact:

- Sylvie Sahal-Bréchot, Observatoire de Paris, LERMA, Meudon, France
- Milan S. Dimitrijevic, Astronomical observatory, Beograd, Serbia
- Nabil Ben Nessib, King Saud University , Riyadh, Saudi Arabia.
- Nicolas Moreau, Observatoire de Paris, LERMA, Meudon, France

VAMDC consortium — l'Observatoire de Paris — PADC Paris Astronomical Data Centre — Astronomical Observatory, Belgrade

Diagnostics and Modelling in Astrophysics: Understanding of the evolution of stars

- *Thanks to considerable developments of*
  - *Ground based and space-born missions*
  - *Increased sensitivity (S/N) and spectral resolution*
  - *Powerful computers*



Stellar interiors studies and Asterosimology

- opacities: a great number of lines of higly ionized elements are

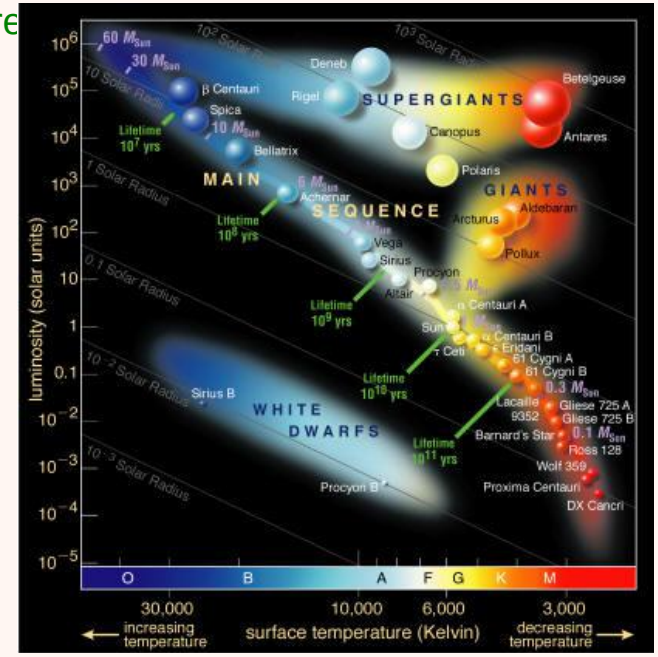
Nuclear processes:

- formation of elements, chemical enrichment

Interpretation of the faint observed spectrum :

faint objects (white dwarfs), faint lines (trace elements)

- Line intensities + line profiles
- Continuum
- Spectroscopic diagnostics:
  - Temperatures
  - pressure



Diagnostics and Modelling in Laboratory and Technological plasmas

- *Magnetic confinement fusion: moderately dense and hot plasmas*
- *Inertial confinement fusion (laser fusion, ion-beam fusion): dense and very hot plasmas*
- *Low temperatures plasmas*
- *Lighting discharges*

Analysis and interpretation of the spectrum in fusion devices

- Light elements in the divertor and edge plasma regions
- Importance of Tin, Tungsten and impurities

Progress in low-energy light sources

- Discharge lamps and lighting :
  - optimisation of performances
- Rare earth elements Dy, Ho, Ce: excellent radiation sources
- HID (*High Intensity Discharge*): MH (*Metal Halide*) lamps, e.g. DyI3, InI, ZnI3

STARK-B: Next steps

- Insertion of MSE data(in progress)
- Insertion of little “applets” on line for users:
  - ✓ extrapolation or interpolation
    - along principal quantum numbers,
    - charge of the radiating ions (isoelectronic sequences),
    - charge of the ion collider
    - homologous ions,

- Future:
  - ✓ SCP code on line: STARK-C project
  - ✓ Insertion of quantum data in intermediate coupling: SST + DW, AS

especially adapted to highly charged ions and resonance lines *(Sahal-Bréchot with Elabidi & Ben Nessib (2004 and after, an also with Dubau and Cornille 2007 and after)*

SERBIAN VIRTUAL OBSERVATORY

Funded by Ministry of Education and Science through grants:
- TR13022/2008 "Serbian Virtual Observatory"
- III44002/2011 "Astroinformatics: Application of IT in Astronomy and Close Fields"

- HOME
- PHOTO PLATES ARCHIVE 1934–1996
- BEAMDB / EMOL
- MOLD
- STARK-B
- FUNDAMENTAL CATALOGS
- BIG SKY EARTH / BELGRADE

VISIT:

- **Archive of photo plates** taken at Astronomical Obsevatory in Belgrade 1934–1996
- **EuroVO** for latest in the European Virtual Observatory
- **IVOA** for a info about International Virtual Observatory Association

NEWS:

- **MC and WG Meetings of COST Action 1403** "Big data in sky and Earth Observations" will be held in Belgrade March 30–31
- **MolD – VAMDC node** In association with Institute of Physics, a new VAMDC node is established for molecule photodissociation data
- **EMol / BEAMDB – VAMDC node** for atomic collisions. In association with LaCP @ Institute of Physics
- **AGN workshop in Koncharevo** 7–11 October 2014
- **SCSLSA is back – 10th edition** – Srebrno jezero June 15–19 2015
- Try our new service for **fitting FeII template in AGN's.**

Maintained by Darko Jevremović. Questions or Comments? Click here to send an email.

BEAMDB - Belgrade electron/atom(molecule) database - Mozilla Firefox

(18) AOB Webmail :: Inbox | XI BULGARIAN-SERBIAN AS | Stark-b | BEAMDB - Belgrade electron/at | Server Not Found

servo.aob.rs/emol/

Laboratory for Atomic Collision Processes

Belgrade electron/atom(molecule) database (BEAMDB)

Laboratory for Atomic Collision Processes :: Institute of Physics Belgrade

Nano-IBCT

Collision Type: ---------

Species: ---------

Species State (product): ---------

Cross Section Type: ---------

Search

Menu | Belogradc... | [files] | BEAMDB - ... | KINGSTON | Felix romul... | Dimitrijevic... | Wicd Netw... | 5.9 k | sr | 16 °C | Tue May 15, 07:03

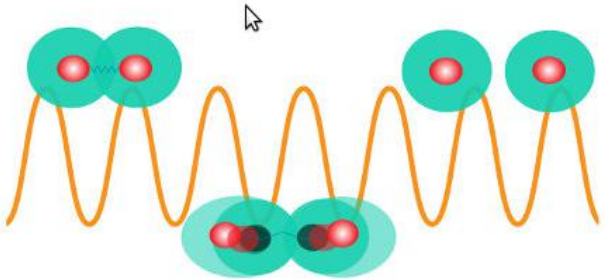
MolD - Photodissociation Database - Mozilla Firefox

(19) AOB Webmail :: Inbox | XI BULGARIAN-SERBIAN AS | Stark-b | MolD - Photodissociation Datab | Server Not Found

servo.aob.rs/mold/

Photodissociation - MolD database

Institute of Physics Belgrade :: Astronomical Observatory Belgrade



individual cross sections | average thermal cross sections | plot

Molecule: ---------

QNJ:

QNv:

Search

If you find this service (data) useful, please cite the following paper

Vujčič, V.; Jevremović, D.; Mihajlov, A. A.; Ignjatović, Lj. M.; Srećković, V. A.; Dimitrijević, M. S.; Malović, M.
MOL-D: A Collisional Database and Web Service within the Virtual Atomic and Molecular Data Center
Journal of Astrophysics and Astronomy, 2015, Volume 36, Issue 4, pp.693-703

cost | VAMDC consortium

Menu | Belogradc... | [files] | MolD - Pho... | KINGSTON | Felix romul... | Dimitrijevic... | Wicd Netw... | 10.3 k | sr | 16 °C | Tue May 15, 07:04

Fe II (4000-5500 A) template in AGN spectra

Fit one spectrum | Fit multiple spectra

spectrum (plain/text): Browse... No file selected.

Temperature (K):

Doppler width of Fe II lines (km/s)

The shift of Fe II lines (km/s):

Intensity of F Fe II group of lines:

Intensity of S Fe II group of lines:

Intensity of G Fe II group of lines:

Intensity of P Fe II group of lines:

Intensity of I Zw 1 Fe II group of l

Number of iterations:

Submit Query

Instructions:

Upload the AGN spectrum within 4000-5500 Å range, with subtracted continuum. Make spectrum to be two column ascii file (wavelength, flux) of "plain/text" mime type, regardless of extension. Put initial parameters in the form. For approximate temperature, width and shift

Fe II lines

Theory

Optical Fe II lines in AGN spectra
The Fe II template
References

Fit Fe II lines

Fit one spectrum
Fit multiple spectra
Fe II template - download

e-mail to:
Jelena Kovacevic
Veljko Vujcic

Instructions:

Upload the AGN spectrum within 4000-5500 Å range, with subtracted continuum. Make spectrum to be two column ascii file (wavelength, flux) of "plain/text" mime type, regardless of extension. Put initial parameters in the form. For approximate temperature, width and shift you may use the values given in the **Test** (down), but for intensities put the values which are approximately the same order of magnitude as the flux in your spectrum. Put 3000 iterations to obtain the best fit.

Test

For testing the program use this spectrum file data_test.txt, and put parameters of fit to be, ie.: 10000, 1500, 0, 4, 3, 3, 3, 1 (with following order). Try application with 0 iterations, and then with 3000 iterations.

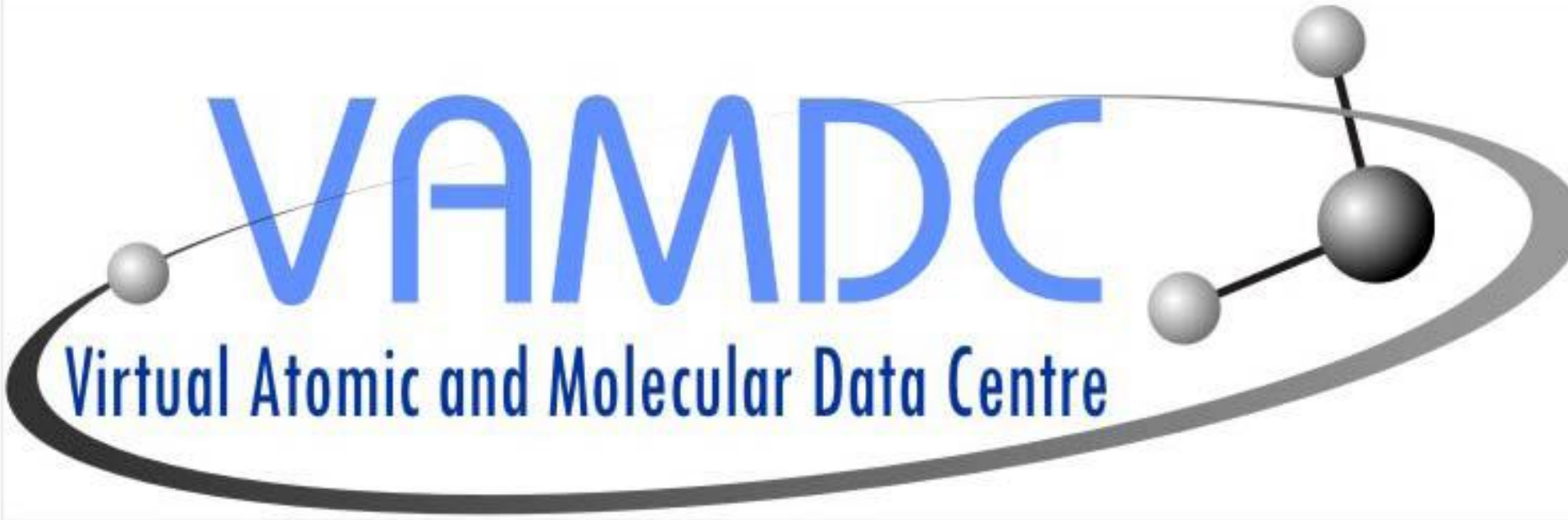
Fit one spectrum: explanation of template parameters and fitting procedure

Acknowledgments

If you find this service useful, please cite the following papers:

1. Kovačević, J., Popović, L. Č. Dimitrijević, M. S., 2010: Analysis of Optical Fe II Emission in a Sample of Active Galactic Nucleus Spectra, ApJS..189...15K. (arXiv:1004.2212)

2. Shapovalova, A. I., Popović, L. Č., Burenkov, A. N., Chavushyan, V. H., Ilić, D., Kovačević, A., Kollatschny, W., et al. 2012: Spectral Optical Monitoring of the Narrow-line Seyfert 1 Galaxy Ark 564, ApJS..202...10S. (arXiv:1207.1782)



VAMDC

Virtual Atomic and Molecular Data Centre

VAMDC Idea

Problems in A&M data community

-LACK OF STANDARDS AND COMMON GUIDELINES

-INTEROPERABILITY problem – prevents productive search and data mining

-DATA EXCHANGE problem – informal, e-mails, ASCII files…

-OVERLAPING OF EFFORTS

VAMDC IDEA

-Majority of developers are Astronomers, Physicists, Chemicists – NEED OF HIRING COMPUTER ENGINEERS

-DATA IDENTIFICATION PROBLEM -XML schemata keys not only for data exchange but also for data identification

Virtual Atomic and Molecular Data Center

Virtual Atomic and Molecular Data Center (VAMDC) started 2009 as an European FP7 project with aims

-To build a secure, flexible and interoperable e-science environment based interface to the existing Atomic and Molecular databases

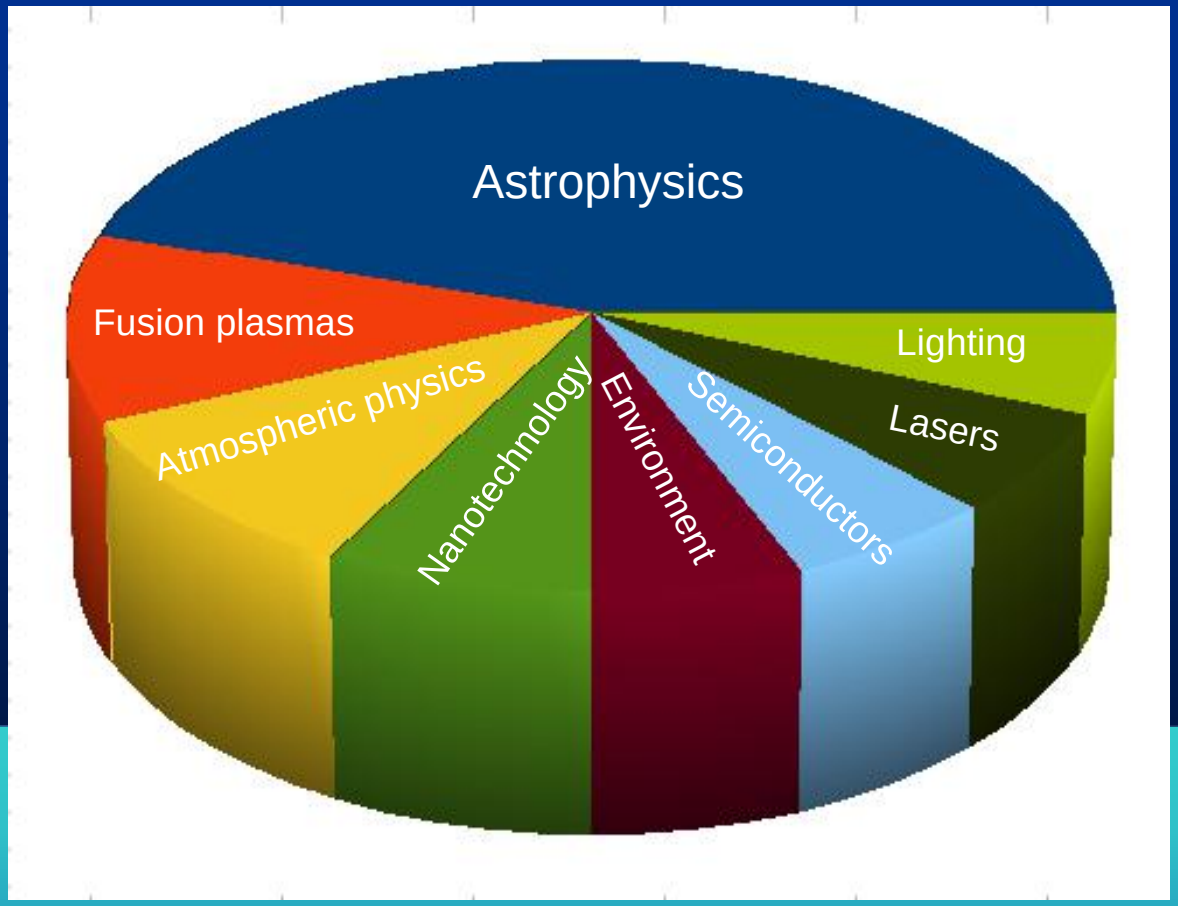
VAMDC

- To work on definition of standards, testing of services

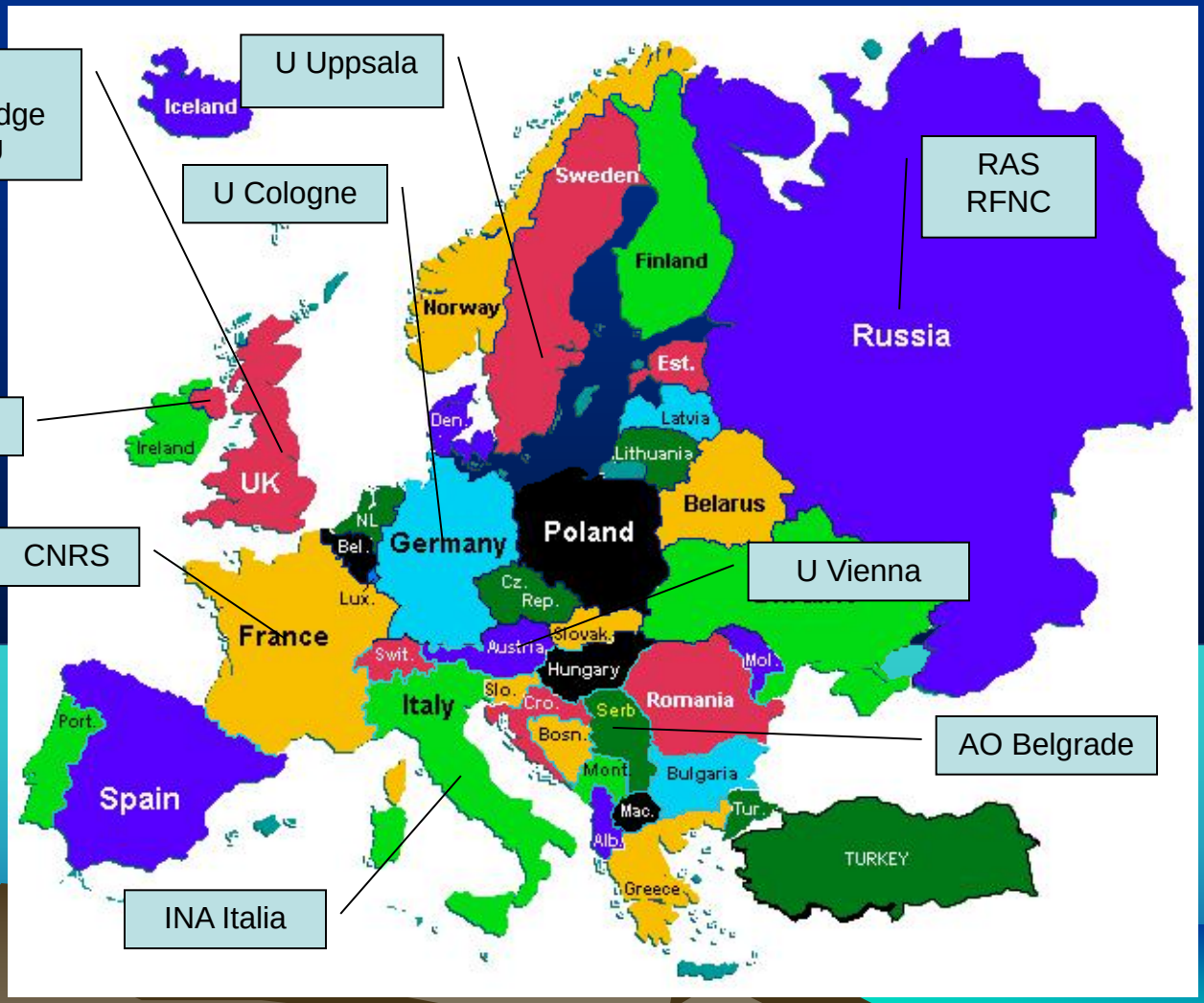
-To coordinate groups involved in the generation, evaluation, and use of atomic and molecular data.

-To provide a forum for training of potential users .

Use of A&M data and VAMDC idea



Participating Institutions. Now 33 databases involved



UCL
U Cambridge
Open U

U Uppsala

U Cologne

RAS
RFNC

NIST

Queen's U

CNRS

U Vienna

IVIC
CeCalCULA

AO Belgrade

INA Italia

VAMDC

Astronomy

Plasma science

Atmospheric Science

Technological plasmas

Fusion community

Radiation science

Lightning industry

THANK YOU FOR ATTENTION