# BELDATA - THE ASTRONOMICAL DATABASE OF ASTRONOMICAL OBSERVATORY: STARK BROADENING DATA INVESTIGATIONS

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## 1. INTRODUCTION

In early-type stars like B and A stars and white dwarfs, Stark broadening is the main pressure broadening mechanism, and the corresponding Stark broadening parameters are of interest for a number of investigations related to stellar plasma. One may mention as examples calculation of stellar opacities, stellar atmospheres modeling and investigations, abundance determinations, interpretation and modeling of stellar spectra and investigation and modeling of subphotospheric layers.

The interest for a very extensive list of line broadening data is additionally stimulated by the development of space astronomy where an extensive amount of spectroscopic information over large spectral regions of all kind of celestial objects has been and will be collected, stimulating the spectral-line-shape research. Consequently, the interest not only for abundant, but also for trace elements data increases. Not only in astrophysics, but also in physics and plasma technology, a number of problems depend on very extensive list of elements and line transitions with their atomic and line broadening parameters. One may mention as examples laboratory plasma diagnostic, research and modeling, radiative transfer calculations and investigation of laser produced plasmas (not only in laboratory but as well in industry during the laser welding, melting and evaporation of different targets), and plasma created in fusion research (particularly inertial confinement and pellet compression fusion), development and modeling of lasers, as well as of light sources.

In a series of papers, large scale calculations of Stark broadening parameters for a number of spectral lines of various emitters (Dimitrijević, 1996, 1997 and references therein) performed on Belgrade Observatory have been published. In order to complete as much as possible Stark broadening data needed for astrophysical and laboratory plasma research and stellar opacities calculations we are making a continuous effort to provide Stark broadening data for a large set of atoms and ions. Our calculations have been performed within the semiclassical - perturbation formalism (Sahal-Bréchot, 1969ab), for transitions when a sufficiently complete set of reliable atomic data exist and the good accuracy of obtained results is expected. From a large set of data for Stark broadening parameters we are going to make a database.

## 2. CONTENTS OF THE DATABASE

Extensive calculations have been performed, up to now (Dimitrijević, 1996, 1997 and references therein) for a number of radiators, and consequently, Stark broadening parameters for 79 He I, 62 Na, 51 K, 61 Li, 25 Al, 24 Rb, 3 Pd, 19 Be, 270 Mg, 31 Se, 33 Sr, 14 Ba, 189 Ca, 28 Ca II, 30 Be II, 29 Li II, 66 Mg II, 64 Ba II, 19 Si II, 3 Fe II, 2 Ni II, 12 B III, 23 Al III, 10 Sc III, 27 Be III, 32 Y III, 20 In III, 2 Tl III, 10 Ti IV, 39 Si IV, 90 C IV, 5 O IV, 114 P IV, 2 Pb IV, 19 O V, 30 N V, 25 C V, 51 P V, 34 S V, 26 V V, 30 O VI,

21 S VI, 2 F VI, 14 O VII, 10 F VII, 10 Cl VII, 20 Ne VIII, 4 K VIII, 4 Ca IX, 30 K IX, 8 Na IX, 57 Na X, 48 Ca X, 4 Sc X, 7 Al XI, 4 Si XI, 18 Mg XI, 4 Ti XI, 10 Sc XI, 9 Si XII, 27 Ti XII, 61 Si XIII and 33 V XIII multiplets become available.

Data for particular lines of F I, B II, C III, N IV, Ar II, Ga II, Ga III, Cl I, Br I, I I, Cu I, Hg II, N III, F V and S IV also exist.

In order to complete as much as possible the needed Stark broadening data, Belgrade group (Milan S. Dimitrijević, Luka Č. Popović, Vladimir Kršljanin, Dragana Tankosić, Nenad D. Milovanović) used the modified semiempirical approach developed by Dimitrijević and Konjević 1980 for radiators where there is not a sufficiently complete atomic data set for reliable semiclassical calculations. The width and in some cases the shift data for the most intensive lines for the following atom and ion species were calculated by them: Ar II, Ti II, Mn II, Fe II, Pt II, Bi II, Zn II, Cd II, As II, Br II, Sb II, I II, Xe II, La II, Y II, Zr II, Sc II, Be III, B III, Mn III, Ga III, Ge III, S III, As III, Se III, Zn III, Mg III, Ca III, La III, C III, N III, O III, F III, Ne III, Na III, Al III, Si III, P III, S III, Cl III, Ar III, B IV, Cu IV, Ge IV, C IV, N IV, O IV, Ne IV, Mg IV, Si IV, P IV, S IV, Cl IV, Ar IV, C V, O V, F V, Ne V, Al V, Si V, N VI, F VI, Ne VI, Si VI, P VI, and Cl VI lines.

### 3. THE STRUCTURE OF THE DATABASE

Astronomical Database System has as a goal to provide the fast and easy data exchange between Internet users and database. Astronomical Database will be placed on server of the Astronomical Observatory in Belgrade. Access will be managed through Internet with 24 hour online support on address http://www.aob.bg.ac.yu/BELDATA. Astronomical Observatory already has Internet presentation on http://www.aob.bg.ac.yu but Astronomical Database is not in function yet.

The atomic data, part of BELDATA system, will be based on the following components (Fig. 1.):
1. Database is the Stark broadening data set.
2. HTTPD (Hyper Text Transfer Protocol Daemon) or www server that has role to provide mutual HTML document communication between Internet and local server.
3. MI (Manager Interface) will transform HTML format document from HTTPD in appropriate form for DataBase Manager System.
4. DBMS (DataBase Manager System) is capable for manipulating with the database. After data processing DBMS will retrieve the data.
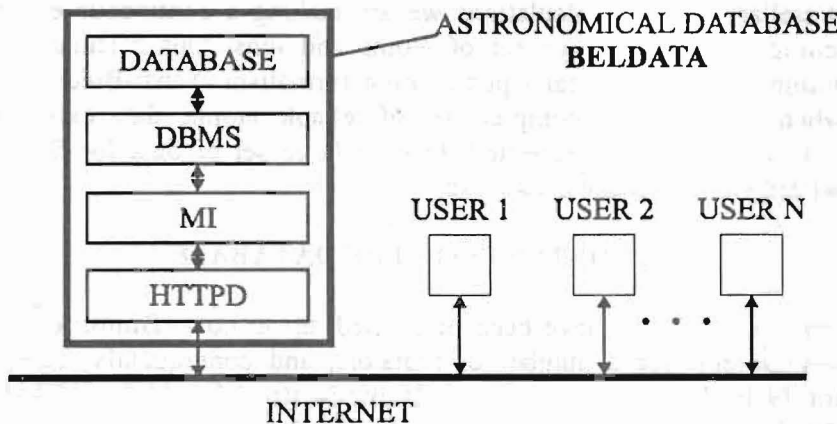


Fig. 1. Scheme of the Astronomical Database

The data will be taken by MI, transformed to HTML format document and proceeded by HTTPD over Internet to user.

Query form, which will be fulfilled by an Internet user, have two return option: data needed for laboratory plasma modeling and data needed for stellar plasma modeling. In future, BELDATA will be extended with spectra of active galactic nuclei and solar spectra. New Stark broadening parameter data will be added to the database when calculated.

Whole system needs constant maintenance effort. Moreover, we have planned to expand capabilities of DBMS. Presently, it is one executable program which may take the needed data from the database but in the future it will be a complex system with numerous functions. These functions will include various database multiple search options fully configurable within one HTML form controlled by user.

## References

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