

VALD-2 – THE NEW VIENNA ATOMIC LINE DATABASE

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Received October 7, 2000.

Abstract. We provide a brief outline of the concepts and facilities of the Vienna Atomic Line DataBase in its new version 2. A summary of contents and recommendations how to use the VALD-2 are given. We conclude by a few applications planned for future releases of VALD.

Key words: atomic data – methods: spectroscopic – stars: abundances – stars: chemically peculiar

1. INTRODUCTION

The VALD-2 (Vienna Atomic Line DataBase, version 2) is the result of a collaboration between astronomers from Austria, Russia and Sweden. Over the last six years, the main goal of the VALD team (at the moment formed by P. Barklem, F. G. Kupka, N. E. Piskunov, T. A. Ryabchikova, H. C. Stempels and W. W. Weiss) was the compilation of accurate and complete lists of atomic transition data to fulfil different requirements set by opacity calculation for stellar atmospheres and high precision spectroscopy. Such data usually are inhomogeneous, since high accuracy in wavelength or oscillator strengths can be achieved only for a limited number of spectral lines which are far too small in number to account for all the line opacity

sources found in stellar atmospheres. Hence, it was necessary to establish a ranking procedure to select the best known line parameters. In addition to the compilation and evaluation of line lists, a set of software tools has been developed for VALD. The database is easy to expand, it allows simple access both from the users and from the program developers, and it provides quick access to single entries in the database, as well as the extraction capabilities for large line lists as required, e.g., for the calculation of opacity distribution functions (Kupka & Piskunov 1998, Piskunov & Kupka 2000). VALD may be used either to compare line parameters available for a particular transition from different sources or to extract sets of the “best known” transition data together with a compilation of references and quality criteria.

2. CONCEPTS AND CAPABILITIES

VALD provides all data in a standard format (Kupka et al. 1999). All lines included into VALD have information on central wavelength, atomic species, the gf-value and energy levels, as well as the total angular momentum quantum number of both lower and upper energy levels. Frequently, also the data on Lande factors, damping constants, term designation, accuracy and multiplet designation are provided. For individual lines it is possible to extend this information using flags which may link VALD with other databases. Extensive descriptions of these data and their original references have been published (Piskunov et al. 1995, Ryabchikova et al. 1999, Kupka et al. 1999).

To compile data from different lists, approximate accordance in wavelength and upper energy level, as well as strict agreement in quantum numbers and species identifier are required. The selection of a particular datum is decided on the base of a ranking list. In addition to user supplied ranking lists a default ranking list is provided by the VALD team which is based on error estimates from original data sources, extensive intercomparison with existing (alternative) data, and applications to astrophysical problems. Each of the three mirror sites offers the same default ranking and data, as well as extraction modes either specific to the analysis of a particular star (“extract stellar”) or to general spectroscopic work (“extract element” and “extract all”). It is also possible to intercompare dif-

ferent data sources (“showline”), for details see Ryabchikova et al. (1999) and Kupka et al. (1999).

3. ACCESS TO VALD, STATISTICS OF USAGE AND DATA CONTENTS

Remote access to any of the VALD mirror sites is possible for every user who registers at valdadm@astro.univie.ac.at via e-mail. Web interfaces to VALD are accessible through both <http://www.astro.univie.ac.at/~vald> and <http://www.astro.uu.se/~vald> where also user documentation can be found. All VALD sites are accessible also through e-mail (vald@astro.univie.ac.at, vald@astro.uu.se, and vald@hypatia.gsfc.nasa.gov). The usage of VALD is free, provided that references to both VALD and original data suppliers are made.

In preparation for the JENAM 2000 conference the following user statistics were obtained on May 25, 2000: 347 users from about 30 countries had registered for VALD. Their research fields include mainly astrophysics, but also laboratory spectroscopy, laser physics, optical technology and plasma physics. About one third of them are using VALD on a regular basis and another third at least occasionally. This compares with close to 100 users about three years ago (Ryabchikova et al. 1997). The number of requests has increased over the last 3 years by more than an order of magnitude to a total of 25 913 on all three mirror sites, including:

extract stellar	– 11394
showline	– 1696
extract all	– 6138
extract element	– 6685

which underlines that for a large number of users VALD has become an “everyday” tool.

The number of lists specifically compiled within the VALD team has increased by a similar amount: while data on some 6834 lines of 13 ions have been processed for the preparation of VALD-1, the total number of data in addition to the compilations of Kurucz (Kurucz 1992) now amounts to 22 856 lines from 58 ions (i.e. 16 022 new lines and 45 new ions without revision of some the VALD-1 data). As an example of our continuous collaboration with persons and institutions communicating their data to us, we mention here that

immediately after the public release of VALD-2 the data on 11 536 lines of C, N and O, recently published by NIST (Wiese et al. 1996) were added to the distribution version of our database.

4. EXTENSIONS PLANNED FOR VALD

For the next generation of VALD we plan the inclusion of molecules (for TiO a prototype version is already operational). Moreover, we intend to increase the number of lines for which accurate Van-der-Waals broadening parameters are available within the database, and we will also include Stark broadening data from the Belgrade database. As a lot of spectroscopic work done by VALD users and by the VALD team deals with chemically peculiar and/or magnetic stars, we will begin to include information specific to autoionization lines (Fano profile parameters), hyperfine-structure split and Zeeman patterns. For some type of data on spectral lines we will provide link information to other databases. Finally, we will continue to complete and improve existing atomic data available within VALD.

ACKNOWLEDGMENTS. This research was supported by the Fonds zur Förderung der wissenschaftlichen Forschung (projects S 7303-AST and P13936-TEC) and by the Swedish Natural Science Research Council (Naturvetenskapliga Forskningsrådet) grant F-AA/FU 11680-300. T.R. received partial financial support through grant 2.2.1.5 of the Russian Federal program “Astronomy”. We cordially thank all the research teams who have provided us with their data for distribution through VALD.

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