NORAD-ATOMIC-DATA

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Description of the database:

NORAD-Atomic-Data is an on-line database at the Ohio State University. It contains large amount high-precision fundamental atomic parameters related to various atomic processes dominant in astrophysical plasams. These processes are atomic excitations and de-excitations involving photons, photoionization, electron-ion recombination. The relevant parameters were computed by Nahar et al using ab inito calculations that employ state-of-the-art R-matrix codes installed at the Ohio Supercomputer Center (OSC). The data sets include energy levels, transition probabilities, lifetimes, level-specific and total photoionization cross sections. and recombination rate coefficients, and some collision strengths for electron impact excitations. The results are new and updated over those at Opacity Project database, TOPbase, and the Iron Project database, the TIPbase, The atomic data are freely available from NORAD-Atomic-Data website at: www.astronomy.ohio-state.edu/ nahar/nahar_radiativeatomicdata/index.html

The data tables are presented in ascii format for easy incorporation in astrophysical modeling codes. The numerical data generated by the R-matrix calculations are processed for complete spectroscopic identification of levels and transitions. In contrast to atomic structure codes, the R-matrix codes do not identify the computed energy levels spectroscopically. These levels are identified using theoretical spectroscopy schemes based on quantum defect theory and percentage channel contributions incorporated in code PRCBPID developed by Nahar (2000) for fine structure transitions and in code ELEVID by Nahar (1995) for LS multiplets.

To prepare for the database, the numerical data are processed by several codes. The energy are put in tables in two different formats, (i) fine structure components arranged together with respect to the corresponding LS terms, similar to that in the National Institute for Standards and Technology (NIST) tables, for diagnostics and laboraotory comparisons, and (ii) in energy order for each symmetry for producing synthetic spectrum or use in models. The transition probabilities are also processed in two formats: i) transitions with complete spectroscopic designations, similar to that of NIST, for diagnostics and comparison with observations, and ii) in long tabular forms for each pair of transition symmetries for astrophysical models. However, the former table considers only a subset of the whole set as these transitions are processed with observed energies. Photoionization cross sections and level-specific recombination rates are also processed with descriptive identifications and for incorporating in astrophysical models.

NORAD-Atomic-Data database contains atomic data for energies and radiative processes of 89 atoms and ions at this time. In contrast to results from atomic structure calculations, the R-matrix computations can consider and yield much larger number of levels and parameters for atomic processes involving the levels. However, computations require much more effort and high-performance computational platforms. Given that it may take up to a year or more to complete the R-matrix calculation for a complex ion, NORAD-Atomic-Data database constitutes a particularly valuable resources for astronomy, physics, engineering etc.

NORAD-Atomic-Data was created in the form of an on-line database in August 2007 and had been accessed over 3500 times by 2012, averaging over 60 times a month, by a broad range of researchers in astronomy, physics, and engineering. The link to NORAD-Atomic-Data are included in several atomic datalink pages, such as, of i) the International Atomic Energy Agency (http://www-amdis.iaea.org/databases.php), ii) CfA-Harvard (http://www.cfa.harvard.edu/amp/ampdata/databases.html), iii) CFADC of Oak Ridge National Lab (http://www-cfadc.phy.ornl.gov/databases.html). iv) IAU Comission 14 Atomic and Molecular Data webpage: (http://www.inasan.ru/iau14/links2012_2015.html)