CHIANTI

An Astrophysical Database for Emission Line Spectroscopy

CHIANTI TECHNICAL REPORT No. 8

The CHIANTI autoionization rate files (auto)

Ver. 1.0, December 26, 2017, Ken Dere

1 General information

The autoionization file is new for CHIANTI version 9. The CHIANTI auto file stores the autionization rates. The autoionization rate is the rate of decay of atomic level through autoionization to a bound level. It also needed to calculate the dielectronic recombination rate from the more highly ionized ions, by means of the principle of detailed-balance. For example, the fe_24 autionizing level 1s $2p^2(^1D)\ ^2D_{3/2}$ can only autoionize to the ground level of the fe_25 ion $1s^2\ ^1S_0$. A somewhat different example are the autoionizing levels of fe_23, such as 1s $2s^2$ 2p $^3P_2$ that can decay to the 3 lowest levels of fe_24, $1s^2$ 2s and $1s^2$ 2p.

2 Data columns

There are three data columns and one free-format column, and each is described below. The format for the column is indicated by Fortran-style notation: *i7*, *a30*, etc.

The end of the data entries is marked by a line containing only '-1'. Comments are then entered in a free format, and the comments are terminated by the end-of-file (EOF).

Column 1 – lower level index *i7*
This contains the level index of the singly-ionized level above the selected ion. The level indices are defined in the CHIANTI .elvlc file of the more highly ionized ion.

Column 2 – upper level index *i7*
The level index of the energetically-higher level of the transition. The level indices are defined in the CHIANTI .elvlc file.

Column 3 – autionization rate *e12*
The autoionization rate in s^{-1}.

Column 6 – free format
After the data columns, there can be a free-format string giving the transition information for the transition. This is used to aid reading the file by eye, and the transition information is not read by the software.

Comments section
The comments section will be free format. It is recommended that, in addition to specifying the citation to a data source, the data assessor should also specify a DOI, or a URL to the ADS page for the paper. For example:

%collision strengths:
Mason, H.E., 1975, MNRAS, 170, 651
DOI: 10.1093/mnras/170.3.651
http://adsabs.harvard.edu/abs/1975MNRAS.170..651M

3 Reading the auto file

The main routine for reading the auto file is read_auto.pro, which is called as:

IDL> read_auto, filename, autostr, autoref

the tags of the structure autostr lvl1, lvl2 and avalue are each 1D arrays containing the three data columns from the file. The output autoref is a string array containing the comment string at the bottom of the data-file.