

2a. The interactive system - working with adf04 datasets

- Preliminaries
 - » Electron impact cross-sections and rate coefficients
 - » The ADF04 file format
 - » Interrogating adf04 collisional excitation data using ADAS201 and ADAS811

Electron impact cross-sections and rates

The excitation reaction $X_i^{+z}(E_i) + e(\varepsilon_i) \rightarrow X_j^{+z}(E_j) + e(\varepsilon_j)$

is described by an excitation cross-section $\sigma_{i \rightarrow j}(\varepsilon_i)$

More useful for tabulation is the collision strength Ω_{ij} with independent variable

$$X = \varepsilon_i / \Delta E_{ij} \quad \text{with} \quad X \in [1, \infty]$$

$$\Omega_{ij} = \omega_i(E_i / I_H) (\sigma_{i \rightarrow j}(\varepsilon_i) / \pi a_0^2) = \omega_j(E_j / I_H) (\sigma_{j \rightarrow i}(\varepsilon_j) / \pi a_0^2)$$

ADAS principally deals with Maxwell averaged rate coefficients $q_{i \rightarrow j}(T_e)$

$$Y_{ij} \quad Y_{ij} = \int_0^{\infty} \Omega_{ij}(\varepsilon_j) \exp(-\varepsilon_j / kT_e) d(\varepsilon_j / kT_e)$$

Electron impact cross-sections and rates (contd.)

More useful for tabulation is the Maxwell averaged collision strength $Y_{ij}(T_e)$

$$Y_{ij} = \int_0^{\infty} \Omega_{ij}(\varepsilon_j) \exp(-\varepsilon_j/kT_e) d(\varepsilon_j/kT_e)$$

$$q_{j \rightarrow i}(T_e) = \frac{\omega_i}{\omega_j} \exp(\Delta E_{ij}/kT_e) q_{i \rightarrow j}(T_e) = 2\sqrt{\pi} \alpha c a_0^2 \frac{1}{\omega_j} [I_H/kT_e]^{1/2} Y_{ij}$$

The ADAS adf04 format is used to archive sets of energy level lists, A-values and Maxwell averaged collision strengths for an ion sufficient to allow a population calculation.

Configuration specification

$$\Gamma = n_1 l_1^{q_1} n_2 l_2^{q_2} \dots n_m l_m^{q_m}$$

where $q_i > 0$ for $i = 1, \dots, m$ and $\sum_{i=1}^m q_i = N$

ADAS prefers Standard and Eissner configuration representations in ADF04 files for automatic processing and matching of levels between different data sets.

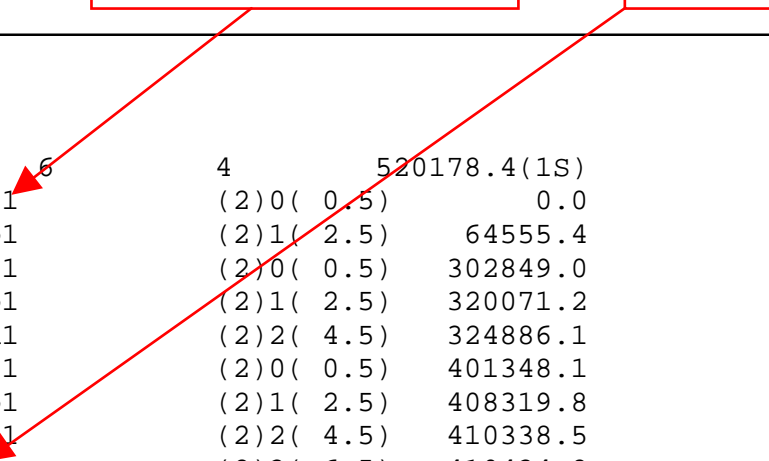
Configuration	Standard form	Eissner form
$1s^2 2s^2 2p^4$	1s2 2s2 2p4	21522543
$1s^2 2s^2 2p^6 6f^{11}$	1s2 2s2 2p6 6fb	2152254361J

The basic adf04 file

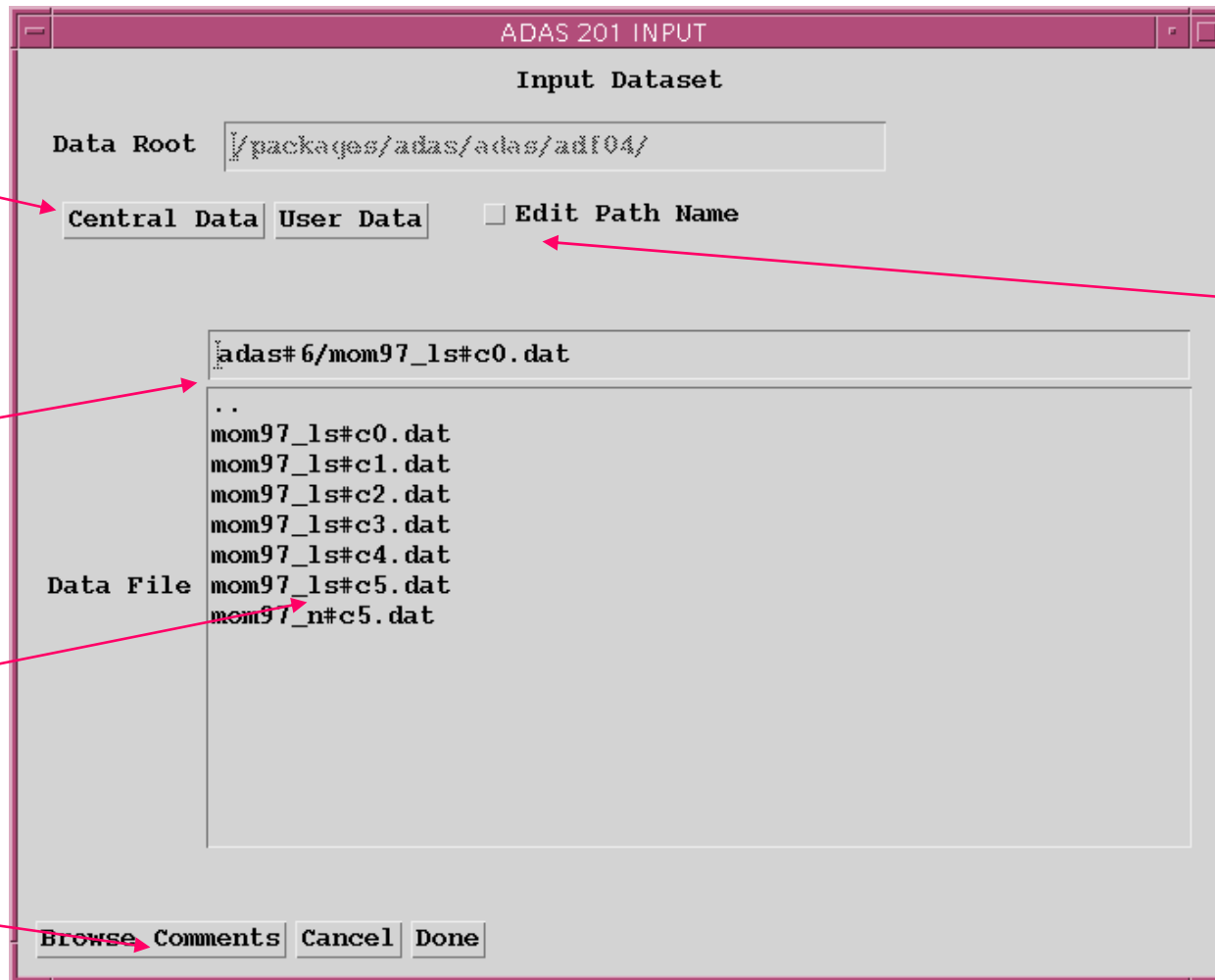
Standard form for
configuration
= 21512
in Eissner form

Eissner form for
configuration
= 1s2 4f1
in Standard form

```
C + 3      6      4      520178.4(1S)
 1 1s2 2s1 (2)0( 0.5)      0.0
 2 1s2 2p1 (2)1( 2.5)     64555.4
 3 1s2 3s1 (2)0( 0.5)    302849.0
 4 1s2 3p1 (2)1( 2.5)    320071.2
 5 1s2 3d1 (2)2( 4.5)    324886.1
 6 1s2 4s1 (2)0( 0.5)    401348.1
 7 1s2 4p1 (2)1( 2.5)    408319.8
 8 1s2 4d1 (2)2( 4.5)    410338.5
 9 2151A   (2)3( 6.5)    410434.2
10 1s2 5s1 (2)0( 0.5)    445368.5
11 1s2 5p1 (2)1( 2.5)    448860.5
12 1s2 5d1 (2)2( 4.5)    449889.2
13 1s2 5f1 (2)3( 6.5)    449939.8
14 1s2 5g1 (2)4( 8.5)    449948.4
-1
```



ADAS201 input



click to use central ADAS data

selected file for processing

ADF04 data file list

browse comments from selected data set

click to edit pathway

ADAS201 Processing

ADAS201 PROCESSING OPTIONS

Title for Run

Data File Name: /packages/adas/adas/adf04/adas#6/mom97_1s#c0.dat

Number of Electron Impact Transitions : 992
Number of Index Energy levels : 64

Polynomial Fitting

Fit Polynomial value % :

Select Specific Electron Impact Transition

TRANSITION INDEX	---	LOWER LEVEL INDEX	---	DESIGNATION	---	UPPER LEVEL INDEX	---	DESIGNATION
541	1	2S2 2P2	(3)P(4.0)	17	2S2 2P1 3D1	(3)D(7.0)		
1	1	2S2 2P2	(3)P(4.0)	2	2S2 2P2	(1)D(2.0)		
2	1	2S2 2P2	(3)P(4.0)	3	2S2 2P2	(1)S(0.0)		
3	1	2S2 2P2	(3)P(4.0)	9	2S2 2P1 3P1	(3)D(7.0)		
4	1	2S2 2P2	(3)P(4.0)	11	2S2 2P1 3P1	(3)P(4.0)		
5	1	2S2 2P2	(3)P(4.0)	12	2S2 2P1 3P1	(1)D(2.0)		

Select Temperatures for output file

Output Electron Temperatures

INDEX	Output	Input
1	1.000E+00	8.617E-01
2	1.500E+00	1.077E+00
3	2.500E+00	2.154E+00
4	4.000E+00	3.231E+00

Temperature Units: eV

Edit the processing options data and press Done to proceed

your title to appear on graphs & tables

number of transitions and levels

make polynomial fit to data

select transition for analysis

Select & enter Te values for output

set default output values

ADAS201 Output

ADAS201 OUTPUT OPTIONS

Data File Name: /packages/adas/adas/adf04/adas#6/mom97_ls#c0.dat

Browse Comments

Graphical Output

Graph Title: User manual example

Select Device: Post-Script

Post-Script
HP-PCL
HP-GL

Explicit Scaling X-min: X-max: Y-min: Y-max:

Enable Hard Copy Replace

File Name: adas201_graph.ps

Text Output Append Replace Default File Name

File Name: adas201_paper.txt

Cancel Done

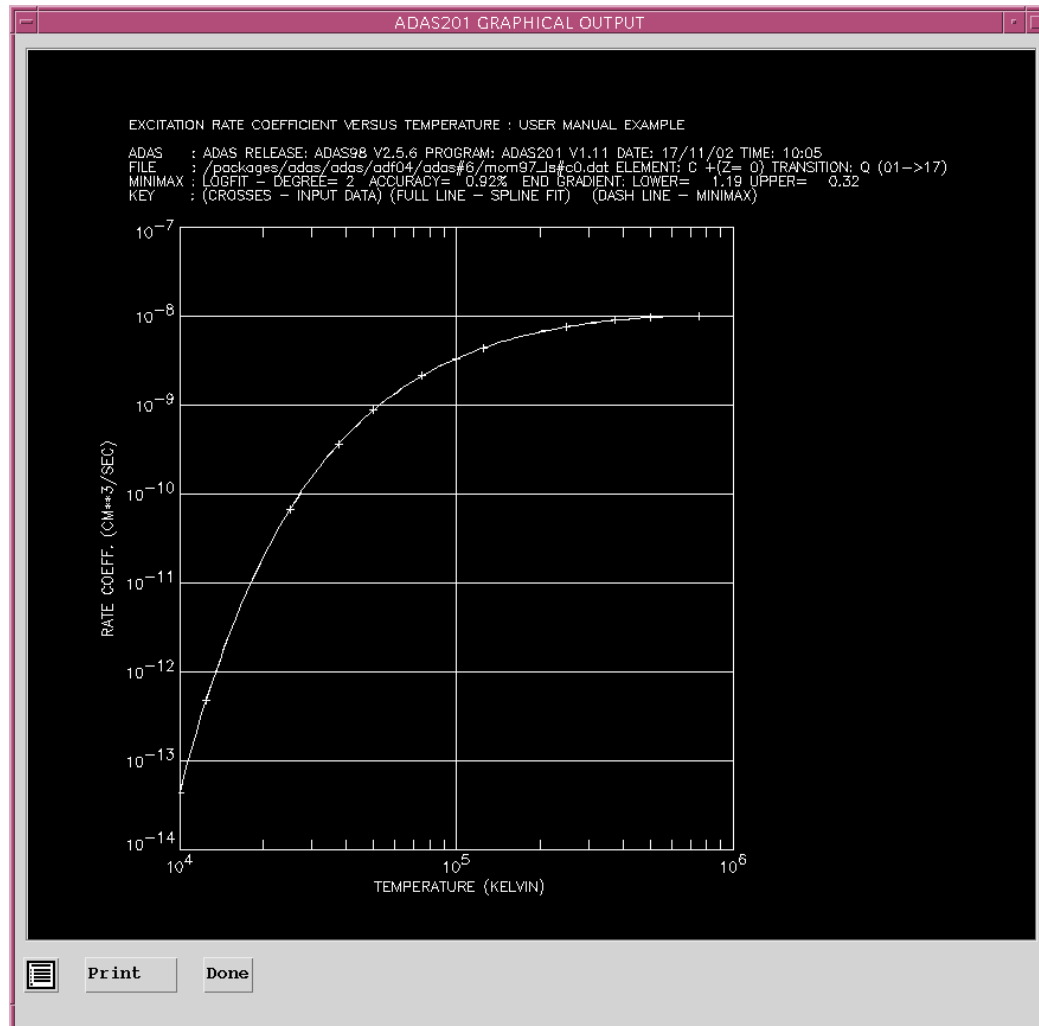
provide graphical output

allow graphical hard copy

graphical output file coding

tabular output of results

ADAS201 Graph



ADAS811 input

ADAS811 INPUT

adf04 file 01:

Data Root

Edit Path Name

Data File

- helike_hps102he.dat
- helike_kv1197he.dat

adf04 file 02 :

adf04 file 03 :

Enter File information

Select first file

Click to show file chooser pop-up

ADF04 data file list

Second and third files

browse comments from first data set

ADAS811 Processing

select file to cycle through

comparative graph for matched transitions

tape recorder keys

select type e-exc

select type of e-exc display

select Te units

Choose file to scan through:

- /home/summers/adas/adf04/helike/helike_hps102he.dat
- /home/summers/adas/adf04/helike/helike_kv1197he.dat
- /packages/adas/adas/adf04/adas#2/mom97_1s#he0.dat

Effective Collision Strengths

gamma

Electron Temperature (K)

Type of plot:

- e-exc
- p-exc
- rec.
- ionis.
- CX

Type of e-exc:

- gamma
- rate
- C-plot

1.5000

Units of Te:

- K
- eV

1 of 171 Show 2 : 1

Cancel Print Print All (154.0, 0.1795)