Explaining the flow of fundamental data into ADAS

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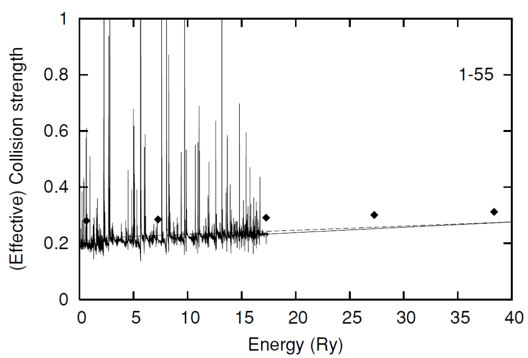
Data Provision

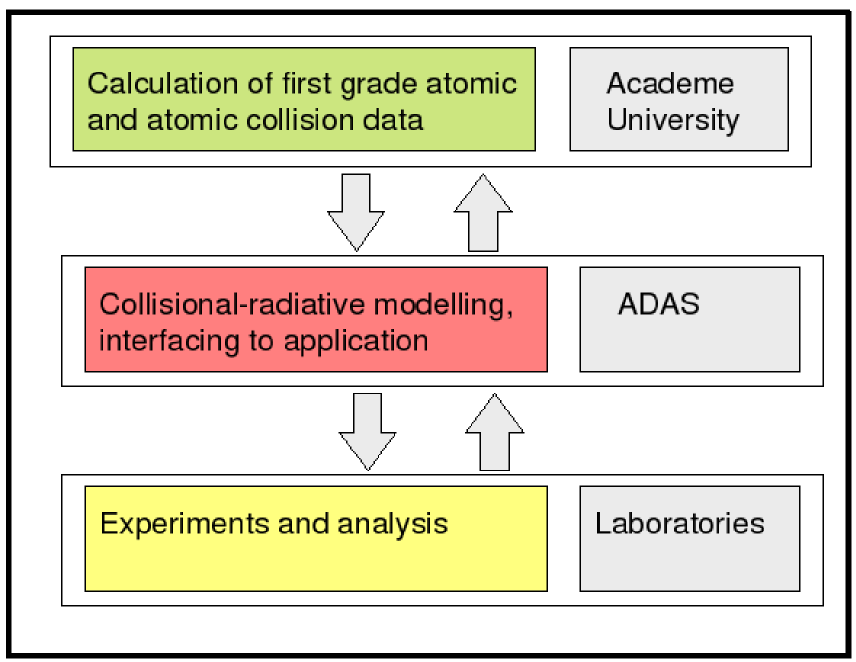
- ADAS, and the data catalogued, has been orientated to interpreting experimental data — predictive modelling came later.
- It became clear more than fifteen years ago that active steps had to be taken by the project to improve the fundamental atomic data availability for ADAS.
- This has been very effective, has involved many workers and has provided a huge amount of high quality data. This production continues as a dispersed activity amongst many.
- So far this has been a true collaboration without too mant legal style contractual obligations.

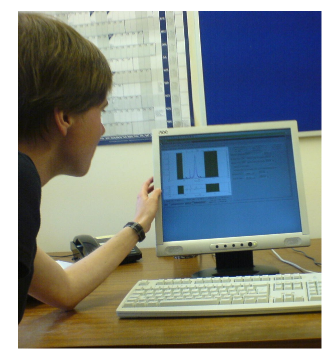
Past, present and future of fundamental data

- Past : relatively low volume of data.
- Present : Automation of sophisticated codes leading to much more data.
- Future : Expect even more.

A primary goal of ADAS is to ‘transform’ fundamental data into a form suitable for diagnostic interpretation and plasma modelling.







Derived, fundamental and driver data

We make a distinction between derived, fundamental and driver data.

- **Fundamental data** are core atomic data necessary for modelling: A-values, cross sections, effective collision strengths etc.,
  - some generated in-house but many come from literature, data centres etc.
- **Derived data** are data tailored for modelling: effective emission coefficients, effective ionisation/recombination rates etc.,
  - most of these data are unique to ADAS and is one of the main differences between ADAS and other data centres.
- **Driver data** allow complete regeneration of all ADAS derived data (and some fundamental data) in conjunction with the various ADAS codes,
  - unique to ADAS and of no use/interest to non-ADAS users.

The ADAS database

- All data are strictly formatted according to ADF numbers (ADAS data format).
- Currently 50 distinct ADF numbers (some placeholders).
- Central ADAS is the same at all ADAS sites — remotely updated.
- Local ADAS — mirrors structure of central database for each user/institution and is maintained by them.
- All files sit flat on a conventional UNIX filesystem.
- With release 2.12, 2.8GB of data in 19,518 distinct files.
- All data is stored as ASCII and in quasi-human readable file formats:
  - allows manual creation of datasets by users,
  - database has survived for $>$ 20 years; ASCII was a good choice!

OPEN-ADAS data classes

Class	Description	Files	Size
ADF01	Charge exchange cross sections	118	1.9 MB
ADF04	Resolved specific ion data collections	1078	463.8 MB
ADF07	Electron impact ionisation coefficients	67	589.4 kB
ADF08	Radiative recombination coefficients	100	465.4 kB
ADF09	Dielectronic recombination coefficients	1619	1.1 GB
ADF11	Iso-nuclear master files	352	45.4 MB
ADF12	Charge exchange emission coefficients	43	1.1 MB
ADF13	Ionisation per photon coefficients	153	35.2 MB
ADF15	Photon emissivity coefficients	176	74.5 MB
ADF21	Effective beam stopping coefficients	218	1.8 MB
ADF22	Effective beam emission coefficients	402	3.4 MB
	Total	4228	1.58 GB

Fundamental data production

Sources of (vast quantities) of fundamental data — delivered in *adf* formats:

- DR Project and BBGP developments.
- Heavy species activities.
- Photo-ionisation/excitation APAP network.
- R-matrix — “a breeze”.
- CA ionisation.
- Not forgetting the literature!

Steady movement of leading edge codes into ‘workhorse’ mode.

Archiving data in ADAS still necessitates that the data is scrutinised and recommended data is included in the central database.

Scrutinising data — Past

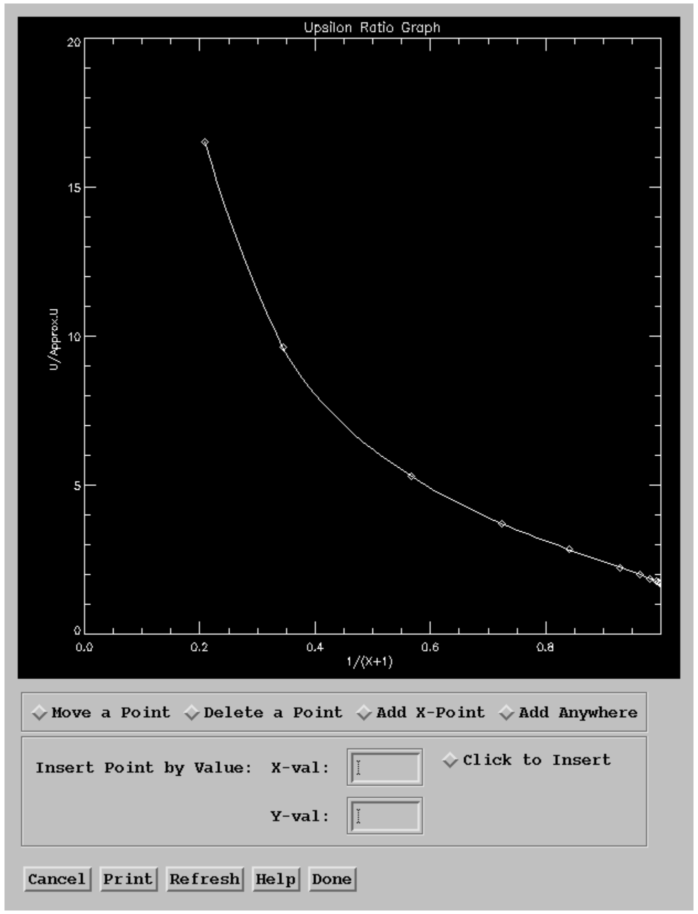
Low data volume : inspection of each transition is possible — ADAS series 1

Table 1.14.1. Collision strengths for Si XIV. Baluja 10039.

	1s-2s
E_{ij}(Ryd)	147.28
x	
1.00	3.79(-3)
1.33	3.88(-3)
2.67	4.04(-3)
5.33	4.20(-3)
10.67	4.34(-3)
13.33	4.37(-3)
26.67	4.45(-3)

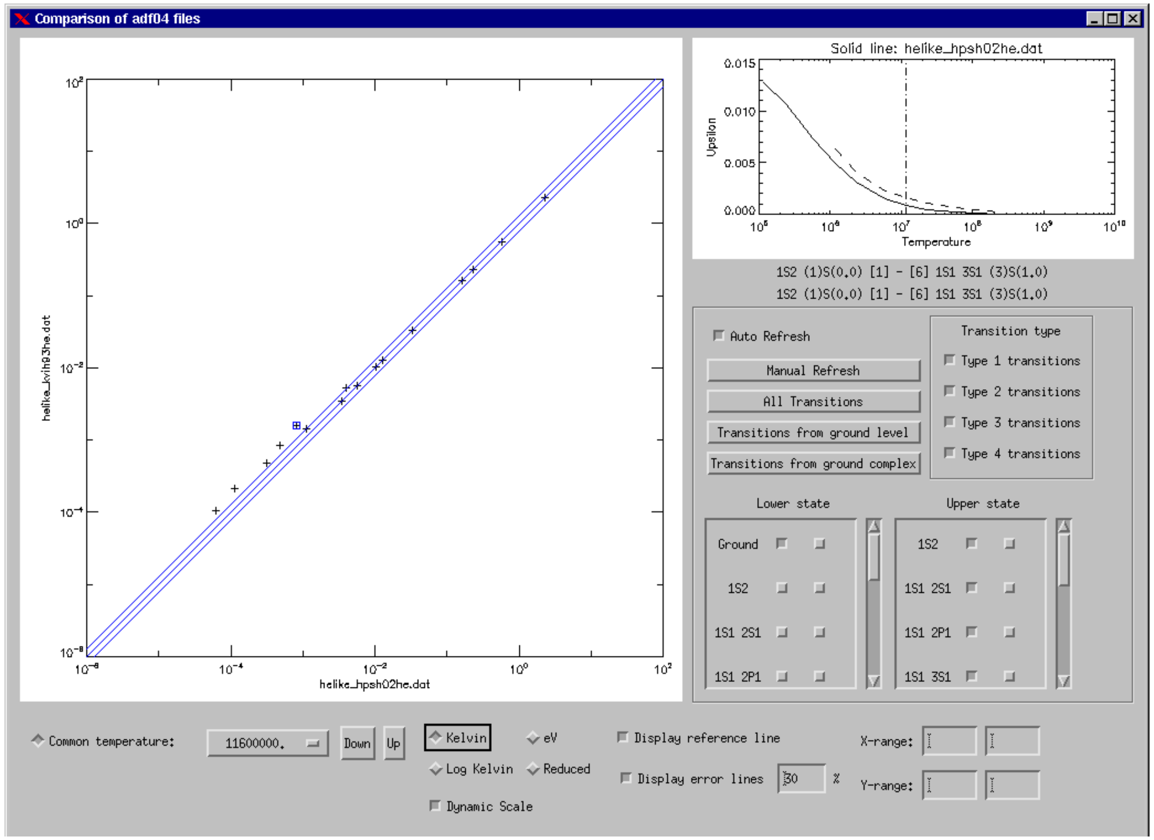
Table 1.18.1. Cross sections (10^{-16} cm^2) for Ar XVIII. Oza 17800.

	1s-2s	1s-2p
E_{ij}(Ryd)	243	243
1.05	3.55(-6)	1.52(-5)
1.25	3.00(-6)	1.39(-5)
1.5	2.56(-6)	1.32(-5)
2.0	1.97(-6)	1.23(-5)
2.5	1.60(-6)	1.15(-5)
3.0	1.43(-6)	1.09(-5)
4.0	1.13(-6)	9.72(-6)
5.0	9.13(-7)	8.81(-6)
6.0	7.69(-7)	8.07(-6)
8.0	5.85(-7)	6.93(-6)
10.0	4.73(-7)	6.11(-6)
15.0	3.20(-7)	4.78(-6)
20.0	2.41(-7)	3.97(-6)



Scrutinising data — Present and beyond

Automated inspection techniques of code generated are required



Some embellishment of data will still be required — but archive both!

A possible scheme for identifying the ‘best’ data

Some ions have more than one dataset — which should I use?

```
C-------------------------------------------------------------------
C  Recommended data
C
C  H P Summers
C  25-Dec-2008
C-------------------------------------------------------------------

C-------------------------------------------------------------------
C  Lost favoured status to .../adas/adas/adf01/qcx#h0/qcx#h0_new#ge32.dat
C
C  A Giunta
C  26-Dec-2008
C-------------------------------------------------------------------
```

- Still a degree of archaeology involved.
- Parasable for OPEN-ADAS.

Conclusions and apologies

- Occasionally fundamental data comes before an experiment.
- Sometimes the experimental need precedes data — tungsten!!
- Atomic model must deal with incomplete data
- Baseline data is important.
- Targeted High quality data is essential.

Hopefully ADAS is steering a sensible course and not offending either data providers or users