

§8. Atomic and Molecular Numerical Databases and Data Activities

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We have constructed and made public atomic and molecular (AM) numerical databases for various collision processes, mainly for fusion plasma research but also for other areas such as astrophysics, applied-science with low temperature plasmas, plasma processing, etc. The AM data activities in Japan were initiated in 1970s.

The current web accessible database system¹⁾ has been opened and maintained since 1997. The database system consists of 6 sub databases. Table 1 shows a list of AM and PWI numerical databases. For a bibliographic database “ORNL” original data records were collected by Oak Ridge National Laboratory (USA) but no update since 2010. Cross references are partly supported between bibliographic and numerical databases. Users can retrieve numerical data through the web form by element, ionic stage, initial states and other constraints.

The databases include: “AMDIS” for cross sections and rate coefficients for electron impact ionization, excitation, recombination, and dissociation; “CHART” for cross sections of heavy particle collisions; “MOL” for numerical data on molecular collision processes, “SPUTY” for numerical data on sputtering yields for mono-atomic solids and “BACKS” for numerical data on reflection coefficients.

During the 2014 fiscal year, we updated the data for AMDIS, CHART and MOL. A list of publications which data are newly included to the database is shown as “What’s new” window of the database homepage since 2012¹⁾. The working group for atomic and molecular compilation worked on collision processes data for light elements.

Fig.1 shows electron-impact elastic scattering cross sections for methane (CH₄) with new data by Brigg et al.²⁾ calculated with an R-matrix method. Fig. 2 shows electron-impact ionization cross sections for Fe¹⁶⁺ ion with new experimental data using the TSR storage ring³⁾.

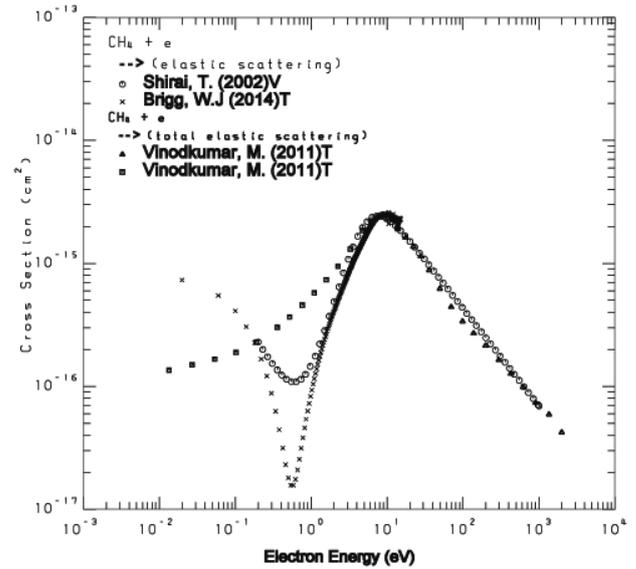


Fig. 1 Electron-impact elastic scattering cross sections for CH₄ molecules as a function of electron energy. New theoretical data by Brigg et al. (2014)²⁾ are included in AMDIS Molecule.

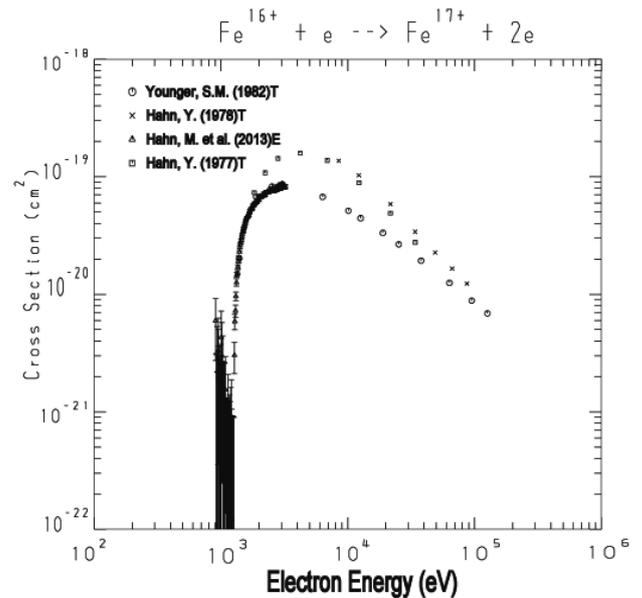


Fig. 2 Electron-impact ionization cross sections for Fe¹⁶⁺ as a function of electron energy. New experimental data by Hahn et al. (2013)³⁾ are included in AMDIS Ionization.

Table 1. AM and PWI databases

Name	No. of Records*	Period
AMDIS	730,469	1929-2013
CHART	7,106	1940-2010
MOL	3,986	1956-2014
SPUTY	2,084	1931-2007
BACKS	396	1957-2002
ORNL	78,097	1959-2009

* as of April 7, 2015.

1) NIFS Database, <http://dbshino.nifs.ac.jp/>

2) W. J. Brigg et al., J. Phys B, **47** (2014) 185203.

3) M. Hahn et al., Astrophys. J, **767** (2013) 47.