§9. 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, appliedscience 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 2015 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 excitation cross sections for Kr^{28+} ion calculated by Zhang and Fontes²⁾ with a relativistic distorted wave method. Fig. 2 shows reaction cross sections for C + H₃⁺ collision with new experimental data using a merged-beam apparatus³⁾.

Name	No. of Records [*]	Period
AMDIS	747,001	1929-2015
CHART	7,616	1940-2013
MOL	5,295	1956-2015
SPUTY	2,084	1931-2007
BACKS	396	1957-2002
ORNL	78,097	1959-2009

* as of April 7, 2016.



Fig. 1 Electron-impact excitation cross sections for Kr^{28+} ion as a function of electron energy. New theoretical data calculated with relativistic distorted wave method by Zhang and Fontes (2015)²⁾ are included in AMDIS EXC.



Fig. 2 Reaction cross sections for $C + H_3^+$ collision as a function of collision energy (laboratory frame). New experimental data measured using merged-beam apparatus by O'Conner et al. $(2015)^{3}$ are included in MOL (CMOL).

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

2) H. L. Zhang and C. J. Fontes, Atomic Data Nucl. Data Tables, **101** (2015) 41.

3) O'Conner et al., Astrophys. J. Suppl., 219 (2015) 6.