EFDA

EUROPEAN FUSION DEVELOPMENT AGREEMENT

Task Force
INTEGRATED TOKAMAK MODELLING

Atomic, Molecular, Surface and Nuclear (AMSN) data for the ITM-TF

Presented by: D.P. Coster (IMP3 Leader)

(Based on the talk given by Lars-Goran Eriksson at the ITM General Meeting, 2008-09)

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Introduction

- A wide range of AMSN data are needed by the ITM-TF.

- AMSN data are needed by several IMPs, especially IMP#3 (transport) and IMP#5 (sources).

- The AMSN task was therefore placed directly under the TF leadership.

- The task was started this year, and we have so far had three remote meetings.

The table shows the names of those who responded to the call for participation in ITM task: ITM-08-TFL-T1 (AMSN data)

	Atomic	Molecular	Surface	Nuclear
Arne Kallenbach	X			
Thomas Pütterich	X			
Joachim Roth			X	
Andreas Kirschner	X	X	X	
Dmitry Borodin	X	X	X	
Detlev Reiter		X		
Bettina Kueppers		X		
Wim Goedheer			X	
Viorica Stancalie	X			
Lorne Horton		Situation	Unclear	

No expert on nuclear data came forward for 2008, we need to find someone for 2009, suggestions are welcome.

IMP#3 needs

- The different data needed by IMP#3 (the ITM-TF project dealing with modelling of plasma transport and discharge evolution) has been reviewed. In particular, for the ETS (European Transport Solver), which should deal with core transport, the following is needed:
- Rate coefficients (as a function of n and T) for
  - ionization,
  - recombination,
  - charge-exchange,
  - nuclear reaction rates
  - cooling rates
- ionization potential
- The elements needed are:
  - High priority (needed in 2008)
    - H, D, T, He, C
  - Lower priority (not needed until 2009 or later)
    - Be, O, N, Ne, Ar, Mo, Ni, Li, Si, B, W

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- IMP#5 deals with Heating, Current Drive and Fast particles
- The main needs of atomic data are for Neutral Beam Injection, charge exchange losses, and synthetic diagnostics (e.g. of high energy NPA at JET)
  - Electron impact ionisation cross sections
  - Ion impact ionisation cross sections
  - Charge exchange cross sections
- Nuclear data for fusion reactions and other nuclear reactions between fast ions and impurities for diagnostics.

On the use of Atomic, Molecular, Surface and Nuclear (AMSN) data in the ITM-TF

- Version control of data imported to the ITM-TF data base is mandatory.

- The provenance of the data must be accurate and stored in the ITM database

- For "production" runs with ITM-TF codes using AMSN data it is important that the data have been given a stamp of approval by an expert.

- The AMSN data must be communicated to ITM-TF codes via a standardised interface (this should also ensure coherence between different ITM-TF codes needing the same type of data)

- The work on providing the AMSN data can be split in to three parts:

I. contact with different databases, including recommendation of the best data to be used/stamp of approval;

II. transfer of appropriate data to the ITM-TF data repository;

III. developments of modules that take AMSN data from the ITM-TF data repository and provide them in a standardized form to ITM-TF codes (see the additional presentation).

- There are two major databases for AMSN data:
  - ADAS for atomic data (and probably also some molecular data in the future)
  - EXFOR for nuclear data (http://www-nds.iaea.org/exfor)
- Since we don't have an expert on nuclear data this year, we decided to start with ADAS.
- Contacts have been established with Hugh Summers and Martin O'Mullane from ADAS, and they have been very helpful.
- We are very pleased that Martin O'Mullane gave a talk to introduce ADAS at the ITM General Meeting.
- The present strategy is to use atomic data as a pilot project to study delivery of AMSN data to the ITM-TF.

- The ITM-TF can provide preferential support (PS) for coordination activities relating to AMSN data.

- We would be very happy to provide PS to people that could help us with coordination.

- We have some liberty in designing a task on the coordination activity.

- Implementation would be through Task Agreements (call for participation to be finalised in October).

Conclusions

- The task on AMSN data has been started up.

- With the support from ADAS we should be in relatively good shape on atomic data.

- Prototype delivery modules are under development (D. Coster).

- We need to make a greater effort on Nuclear data in 2009.

- We also need to look into surface data where most if it appears to reside in private databases.

Challenges

- Atomic cross-section data
  - What AMNS data do you (or will you) need? Which species, reactions, etc? [From a questionnaire sent out to data consumers in IMP3]
    - I [David Tskhakaya] need
      1. the differential cross-sections for plasma-neutral, neutral-neutral and plasma-impurity reactions (elastic, excitation, ionization, dissociation, ...) for H, D, T, He, C, W, Be, ...
      2. Energy and incident angle dependent recycling coefficients for H, D, T, H2, D2, T2, HD, ST, DT, He on C, W, Be. Energy (particle flux) and incident angle dependent (total = chemical + physical) sputtering coefficients for C, W, Be. I need the velocity distribution function of recycled and sputtered particles.