Overview of CRPs; meeting objectives

B. J. Braams and H.-K. Chung

Atomic and Molecular Data Unit, Nuclear Data Section

Atomic and Molecular Data for State-Resolved Modelling of Hydrogen And Helium and Their Isotopes in Fusion Plasma
3rd Research Coordination Meeting, Vienna, 14-16 March 2016

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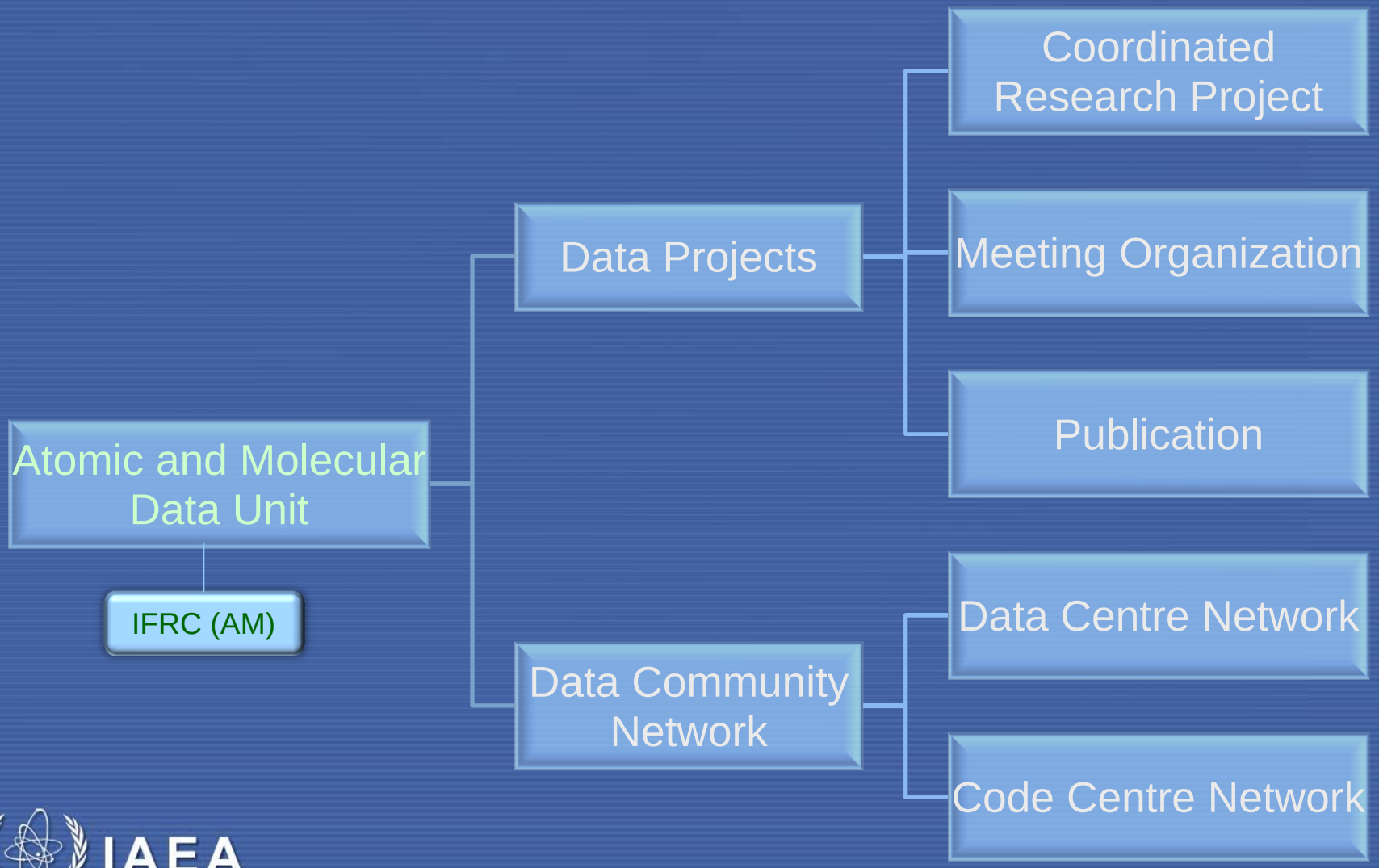
International Atomic Energy Agency

Atomic and Molecular Data Unit Activities



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Coordinated Research Projects

Data Generation and Exchange

CRP: Coordinated Research Project

- Main mechanism by which the AMD Unit encourages new research
- Unique Opportunity for Comprehensive and Synergistic Collaboration

Joint research on Atomic, Molecular & Plasma Surface Interaction Data for fusion:

- Representatives from 10 to 15 institutes world-wide
- Duration 3-4 years; 3 Research Coordination Meetings (RCM)

Objectives: To define and to coordinate international research on:

- Generation, compilation and evaluation of data
- Establishment of databases
- Development of new techniques

Outputs:

- Publications, Meeting Presentations and Reports
- Final Reports in “Atomic and Plasma-Material Interaction Data for Fusion” (APID); more recently in a journal (JPCS, Atoms)
- Data and Results in ALADDIN Numerical Database and Knowledge Base

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Past, Present and Future CRPs

http://www-amdis.iaea.org/CRP

2008-2012: Characterization of Size, Composition and Origins of Dust in Fusion Devices

2009-2013: Light Element Atom, Molecule and Radical Behaviour in the Divertor and Edge Plasma Regions

2010-2014: Spectroscopic and Collisional Data for W from 1 eV to 20 keV

2011-2015: Data for kinetic modelling of molecules of H and He and their isotopes in fusion plasma

2012-2016: Erosion and Tritium Retention for Beryllium Plasma-Facing Materials

2013-2017: Plasma-Wall Interactions with Irradiated Tungsten and Tungsten Alloys in Fusion Devices

2015-2019: Plasma-wall Interaction with Reduced-activation Steel Surfaces in Fusion Devices

2016-2020: Data for Charge Transfer Processes Related to Neutral Beams in Fusion Plasma

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CRP on Spectroscopic and Collisional Properties of Tungsten from 1 eV to 20 keV (2010-2014)

Objectives

- Concerned with W in all plasma regions, edge to core
- Theory and experiment are both represented, with overlap among and between the two
- Aim to produce validated database for tungsten in plasma

Data needs

- Electron-impact, radiative and photon-induced, and heavy particle collision processes
- Cross-sections for kinetic modelling
- Rate coefficients for macroscopic modelling
- Spectroscopic signatures for diagnostics

Research Coordination Meetings

First RCM: 13-15 December 2010

Second RCM: 29-31 August 2012

Third RCM: 06-08 October 2014

Participants

R. SRIVASTAVA	IIT Roorkee
A. MÜLLER	University of Giessen
N. NAKAMURA	University of Electrocommunications
A. RYABTSEV	Russian Academy of Sciences
A. . WYART/ W. TCHANG-BRILLET	Observatoire de Paris
P. BEIERSDORFER	LLNL
C.-Z. DONG	Northwest Normal University
F. KOIKE	Kitasato University
V. NIKULIN/ M. TRZHASKOVSKAYA	St Petersburg Nuclear Physics Institute
V. LISITSA,	Kurchatov Institute
N. BADNELL,	University of Strathclyde
J. COLGAN,	Los Alamos National Laboratory
Yu. RALCHENKO,	NIST
D. KWON	KAERI

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CRP on A+M Data for State-Resolved Modelling of H, He and their Isotopes in Fusion Plasma (2011-2015)

Objectives

- Species H, H^+, H_2, H_2^+, H_3^+, He, He^+, He_2^+, HeH^+, He_2^+, H^- and isotopic variants; isotope effects are important; He is newly important
- Aim to be comprehensive for volume processes among the mentioned species and e-, hv
- Predominantly theoretical; some experiment

Data needs

- State-resolved cross-sections for kinetic modelling
- Electron-impact, radiative and photon-induced, and heavy particle collision processes

Research Coordination Meetings

First RCM: 10-12 August 2011
Second RCM: 3-5 July 2013
Third RCM: 14-16 March 2016

Participants

R. CELIBERTO	Polytechnic of Bari, Italy
U. FANTZ	MPI for Plasma Physics, Garching
C. JUNGEN	Laboratoire Aimé Cotton du CNRS
I. SCHNEIDER	Université Le Havre
V. KOKOOULINE	University of Central Florida
P. KRSTIC	Oak Ridge National Laboratory
X. MA	Chinese Academy of Sciences
O. MOTAPON	University of Douala, Cameroon
A. OREL	University of California at Davis
D. REITER	Forschunszentrum Jülich
K. SAWADA	Shinshu University
X. URBAIN	Catholic University of Louvain
J.-S. YOON	National Fusion Research Institute

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CRP on Data for Charge Transfer Processes Related to Neutral Beams in Fusion Plasma

Planned CRP; tentative title

- Proposal is due in Q2 2016; CRP could start in Q4 2016 or Q1 2017

Core topics and objectives

- Develop data for collision processes of neutral beams in fusion plasma

Scope to be better defined

- Heating and diagnostic neutral beams
- H/D/T beams for sure; He, Li beams most likely; maybe other (Ne, Ar, …)
- Charge transfer processes and related (CXRS) spectroscopy
- Beam excitation and related (BES) spectroscopy
- Motional Stark Effect (MSE) diagnostics
- Processes in the beam generation, negative ion production and neutralization? (Probably not)

Meeting schedule

- Consultancy meeting to help define the scope in March 2016
- First RCM could be near the end of 2016 or early 2017

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Publications

http://www-amdis.iaea.org/publications/

- IAEA-INDC(NDS) Reports (http://www-nds.iaea.org/publications/)
  - Reports are published for every meeting
- International Bulletin on Atomic and Molecular Data for Fusion
  - Bibliographic Information on Atomic, Molecular and Plasma-Surface Interaction Data
- Atomic and Plasma-Material Interaction data for Fusion (APID Series)
  - Data and papers related to results produced by CRPs and Consultants groups
  - All volumes are available on-line (http://www-amdis.iaea.org/publications/APID/)
  - Edition in preparation

    Volume 17: CRP on "Atomic Data For Heavy Element Impurities in Fusion Reactors

    Volume 18: CRP on "Light Element A & M and Radical Behaviour in the Divertor and Edge Plasma Regions"

    Volume 19: CRP on "Spectroscopic and Collisional Data for Tungsten from 1 eV to 20 keV"
- Special issues at Atoms Journals
  - Critical Assessment of Theoretical Calculations of Atomic Structure and Transition Probabilities (2014)
  - Spectral Line Shapes in Plasmas Print Edition available (March 2014)
  - Atomic Data for Tungsten (July 2015)

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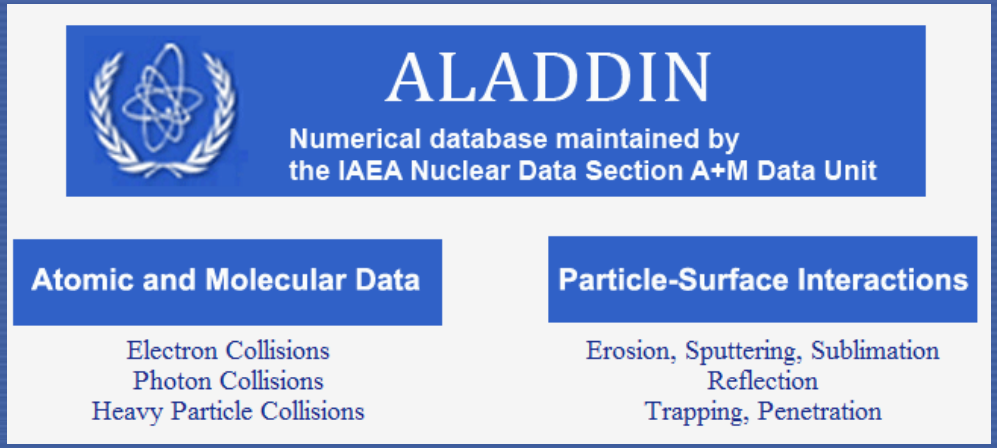
ALADDIN: Numerical Database

Data Dissemination http://www-amdis.iaea.org/ALADDIN



- Originally designed to host “evaluated and recommended” data only
- Currently a mix of evaluated data with CRP participants’ data
- Will host evaluated and recommended data
  - CM on "Evaluation and Uncertainty Assessment for Be, C, Ne Atomic Data"
  - Joint IAEA-KAERI CM on "Recommended Data for Processes of Tungsten Ions”
- New Interface using GOOGLE free search forms is under development

Issues for Present 3RCM on H+He

- Review of recent work by participants
- Discussions and review:
  - Comprehensive database on processes of H and He in fusion plasmas
  - Experimental work; future needs and possibilities
  - Computational work; future work most needed
- Final report: special issue of journal *Atoms* is proposed
- Future activities on data evaluation and recommendation

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