The Controlled Fusion Atomic Data Center (CFADC) Status and review recent activities

Program History, Overview, Status

Data Center Activities
- Bibliography
- IAEA Coordinated Research Programs
- Data Requests

Supporting Activities
- Multicharged Ion Research Facility
- Center for Plasma Edge Simulation
Program History

The Controlled Fusion Atomic Data Center

- Found in 1959 by C.F. (Barney) Barnett
- Its mission is to “identify, compile, evaluate, and recommend data on atomic and molecular collision processes which are important in fusion energy research”

- Principal activities have included producing at first a published, and then by the mid-1970’s, an on-line annotated bibliography used to answer data requests and as a foundation for data evaluation
- Two principal series of “Redbook” volumes of recommended data
- Direct response to data requests
- Participation in the IAEA ALADDIN and DCN network and CRPs
- World wide web resources beginning in 1995
- Significant change in operations beginning in the late 1990’s
Program Overview

The Controlled Fusion Atomic Data Center
Collect, evaluate, and disseminate data to the plasma science community
Schultz, Krstic, Ownby, Meyer, Havener, Bannister

The Multicharged Ion Research Facility
Study fundamental interactions among electrons, ions, atoms, molecules, and materials for plasma science
Meyer, Havener, Bannister, Hale, Vane, Deng, Harris, Draganic

Theoretical Atomic Physics
Develop and apply advanced computational methods in AM&PSI data production and basic science
Krstic, Schultz, Reinhold, Macek, Hui, Park
Program Status

- Despite the positive reviews of the program, the U.S. Department of Energy has decided to close out the ORNL Atomic Physics Program.

- The funding for support of the group will be cut in half in FY12 (October 2011-September 2012) and zero after that.

- Attempts to appeal this decision or gain permission to propose re-starting some level of activity after September 2012 have so far not been successful.
Annotated Bibliography

- Remains one of the most important activities of the CFADC - used in both the plasma science and broader communities
- Approximately 1000 new entries per year added, maintained on-line at CFADC website
- Forms significant part of the A+M Data Unit’s “Bulletin”, and distributed to other international data centers for use
- Ownby*, Schultz, Meyer, Krstic, Havener, Bannister, Gilbody, Pindzola, Thomas, Stancil
- “Challenge” from other on-line sources such as electronic article archives and search engines

Work on the bibliography has been suspended during the close out: Plans exist to propose a re-start of this activity even in the absence of the rest of the program.

* Deceased December 2010
CFADC Participation in IAEA CRPs

Members of the CFADC are frequent participants in IAEA Coordinated Research Programs (CRPs) through which significant data needs are addressed.

Recent CRPs:

2007-09: Data for Surface Composition Dynamics Relevant to Erosion Processes – Krstic, Meyer, Reinhold

2005-08: Atomic and Molecular Data for Plasma Modeling – (Hogan), Schultz, Bannister

2009-12: Light Element Atom, Molecule and Radical Behaviour in the Divertor and Edge Plasma Regions – Schultz, Pindzola, Loch

2011-2014: Atomic and Molecular Data for State-Resolved Modeling of Hydrogen and Helium and Their Isotopes for Fusion Plasmas - Krstic

Participation in CRPs can and will continue through individual contributions (some staff are seeking new positions at ORNL or elsewhere).
Work at ORNL MIRF/CFADC to validate and extend Janev-Reiter hydrocarbon data.

Means of moving key experiments to other institutions is being investigated, but with no progress to report.
Data for Surface Composition Dynamics Relevant to Erosion Processes

Application of CFADC computational simulation of particle-surface interactions and MIRF experimental measurements

Particle-surface interaction work in FY12 is being supported by an internal ORNL grant: PSI seems the most likely experimental/theoretical effort to regain support after the FY12 close-out, but great uncertainties exist as to the level of funding that could be obtained.

Measurement of chemical sputtering – Meyer, Vergara, Harris

Particle reflection coefficients – Krstic, Reinhold
Answering Data Requests

Answering specific requests for data from the plasma science community is the highest priority of the CFADC.

Using CFADC expertise, this is accomplished through:

1. rapid feedback to requests using existing data sources or quick calculations, and
2. longer term data production projects (described later)

We typically respond to about two such requests per month.

Recent example: Needed to provide a wide range of data (much of which did not exist) to a fusion laboratory evaluating transport of Fe in the scrape-off layer.

Some existing data found, much estimated, longer-term project considered.
Operations of the MIRF will continue in FY12, but apparatus would have to be moved to other locations (and with support for their use) or DOE would have to re-start a significant portion of the experimental effort if work using this unique facility is to continue.
Center for Plasma Edge Simulation

ORNL-Auburn work as part of a large national program aiming to prototype simulation efforts in a future Fusion Simulation Project

Focus on edge and boundary regions, particle transport data

- H, He, Be, B, Li, C, and W collisional / radiative data through new supercomputing calculations
- large scale molecular dynamics simulation of particle surface interactions – sputtering, reflection, hydrocarbon chemistry, …
- interface to neutral transport modules, …
- Krstic, Reinhold, Loch, Pindzola, Schultz, Stotler

Integration of AM&PSI data in multiscale edge modeling

As with the MIRF, theoretical work in support of fusion will also continue in FY12, but will require new funding or relocation of the individual staff members to continue after that.
The Controlled Fusion Atomic Data Center (CFADC)
Status and review recent activities

After a long history of contributions to the U.S. and international fusion program, and significant achievements in atomic, molecular, and particle-surface interactions, the CFADC and atomic physics program are being closed out. It is hoped that individual efforts can be sustained and that some core program might be re-started to maintain as much of the expertise, experience, and unique capabilities as possible.