28th Meeting of the Atomic and Molecular Data Centres Network (DCN28)

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Book of Abstracts

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tbc (Recent data activities with Atomic Spectra Database)

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Atomic and Molecular Data Activities at NIFS in 2023-2025

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Atomic and molecular databases and related activities conducted at NIFS during 2023-2025 are reported. Numerical data on collision processes, found in literature, for fusion relevant elements as well as others for various applications such as astrophysics and plasma applications are stored in the databases. Data have been searched by help of working groups by Japanese collaborators. Total number of data record sets in the NIFS Atomic and Molecular Numerical Databases increases to be 1,886,166 which is nearly 15% increase since April. 2023. The data sets in AMDIS EXC, CHART, and AMOL databases are largely increased. Number of database access, counted as number of queries, also increases.

Related research on atomic data and spectroscopy on W, high Z elements such as lanthanides, Kr and BH, has been conducted by NIFS staff and collaborators. Plasma spectroscopy for Large Helical Device (LHD) and compact EBIT (CoBIT) has been carried out and many spectra were obtained. Theoretical calculations on atomic structure, collision cross sections, and collisional-radiative models for those elements and molecules have also been conducted. In addition, plasma parameters were derived from the analysis of the emission spectrum of the hydrogen pellet ablation cloud in LHD experiments. It was revealed that the parameters of the ablation cloud plasma are strongly correlated with the background plasma.

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tbc (Recent data activities with ADAS and OPEN-ADAS)

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tbc (Recent data activities at KFE)

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Recent research for atomic data and collisional-radiative modeling

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Recent research activities for atomic data and collisional-radiative modeling in Korea Atomic Energy Research Institute, atomic data center are reported. Energy levels, radiative transition probabilities, and electron-impact excitation (EIE) and ionization (EII) for W I was calculated with multiconfiguration Dirac-Fock (MCDF) MDFGME code (2024 version). Core-valance (CV) and core-core (CC) electron correlation were considered for configuration interaction of energy levels and the energy accuracies were improved. The radiative transition probabilities by the electron correlation are compared with other available, Hartree-Fock Relativistic (HFR) calculations and MCDF calculation by GRASP code as well as experimental NIST data. The radiative transition probabilities from the different calculations have very large discrepancies from each other and with the experimental data. The EII cross section was calculated Binary encounter Bethe (BEB) model and EIE cross section was obtained by scaled plane wave Born (PWB) approximation. The Maxwellian rate coefficients for EII and EIE are compared with other previous calculational results and discussed. These data are expected to be useful for collisional-radiative modeling for W I which is adopted for the spectroscopic determination of tungsten erosion rate in plasma surface interaction of fusion tokamak. We have also performed measurement and the analysis for the tungsten erosion rate in our plasma beam irradiation facility and are performing it in KSTAR tokamak.

As for collisional-radiative modeling (CRM) activity, we have performed CRM for Ar I and Ar II in low temperature and low density plasma. The effect of considered highly excited levels and the population kinetics processes to the CRM results are presented and discussed in detail with the used atomic data management.

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Recent Progress of Atomic and Molecular Physics for China Research Association of Atomic and Molecular Data

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China Research Association of Atomic and Molecular Data (CRAAMD) is constituted of about ten groups from universities and Institutes and works on collecting, producing and compiling Atomic and Molecular data (AMdata), which are needed from the related fields of astrophysics, Inertial Confinement Fusion (ICF) and X-ray Laser Research etc.

In the first part of this talk, I will introduce recent activities of China Research Association of Atomic and Molecular Data in the past five years. Then I will present some recent progress of our group in IAPCM on fundamental atomic and molecular physics researches, including the atomic processes in plasma environment, an unexpectedly large quantum interference in the dielectronic and radiative recombination of Be-like highly charged ions, and new modelling of the stopping power of α particles to consider the deflection effects due to multiple scatterings.

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tbc (Recent activities on ModCR and PLOUTOS codes)

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Brief introduction to proposal on ”Unifying policies on the management of atomic and molecular data for fusion”

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Current activities of IAEA Atomic and Molecular Data Unit

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tbc (Recent data activities at SPbSTU)

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Study on the Compatibility of Argon Seeding with Helium Exhaust in a Radiative Divertor

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The simultaneous management of extreme heat fluxes on divertor targets and the efficient removal of helium (He) ash are critical challenges for steady-state fusion reactor operation. This study investigates the compatibility of the argon (Ar) seeding radiative divertor strategy—a primary heat mitigation technique—with the essential requirement of helium exhaust.

A systematic scan of the argon injection rate was conducted to achieve varying degrees of divertor detachment. The analysis reveals a non-linear relationship between the detachment degree and helium exhaust efficiency, characterized by an optimal window. During the deep energy detachment phase, the neutral pressure in the divertor initially increases, benefiting helium accumulation and compression. However, pushing detachment too far leads to a subsequent drop in neutral pressure, which becomes detrimental to exhaust. This finding underscores that an optimal detachment level must be precisely controlled to balance heat load reduction with efficient ash removal.

In conclusion, this study confirms that compatibility between an Ar-seeded radiative divertor and efficient helium exhaust is achievable. The key to success lies in operating within an optimal window of detachment. This approach simultaneously enables robust heat flux control and maintains high helium exhaust efficiency, providing a crucial integrated solution for the design of next-generation fusion reactors.

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tbc (Recent data activities at QEB)

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tbc (Recent data activities at CNR Bari)

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