31st Summer School and International Symposium on the Physics of Ionized Gases

POSTDEADLINE PAPERS

DUSTY PLASMA IN ACTIVE GALACTIC NUCLEI

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Abstract. Since many years we know that dust (dusty-molecular torus) is responsible for the obscuration in active galactic nuclei (AGN) at large viewing angles and thus for the classification of AGN. . Recently, we gained some observational and theoretical insight into geometry of the region and the role of the dust in the dynamics of the outflow and failed winds. I will briefly touch on all these aspects, including our dust-based model (FRADO - Failed Radiatively Accelerated Dusty Outflow) of the formation of the Balmer lines in AGN.

TOWARDS A GLOBAL NETWORK FOR LABORATORY ASTROPHYSICS ACTIVITIES AND DATA

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Abstract. A large variety of atomic and molecular (A&M) data is used in astrophysics, both for the analysis of astronomical spectra and for the development of astronomical models of a wide variety of astronomical objects. The same is true for many other application fields, for example in plasmas physics.

Many experimental and atomic groups contribute to the characterization of A&M data, and the building of on-line atomic and molecular databases for astrophysics and for other applications fields have started from the beginning of the internet. That work involved not only scientific work on the data, but also the characterization of the data, which could be seen as the start of the "standardization" of metadata and of the relations between metadata, as it has recently been developed in different communities. In addition, over the past few years the overall context of publication of data has become increasingly complex because of the context of open science initiatives around the world.

This talk starts with the description of the International Astronomical Union B5 commission aims and activities, provides an overview of the life cycle of A&M data, and finally aims at providing the keys leading to a "Global Network for Laboratory Astrophysics Activities and Data".

Acknowledgement

This talk is fueled by the work performed by different actors over the years : databases, institutions such as the IAEA, the NIST, the IUPAC, infrastructures such as the VAMDC and more recently from the IAU B5 commission and its working groups, not forgetting the past history of other commissions linked to atomic and molecular data at the IAU.

Acronyms :
IAEA : International Atomic Energy Agency (iaea.org)
NIST : National Institute of Standards and Technology (www.nist.gov)
IUPAC : International Union of Pure and Applied Chemistry (iupac.org)
VAMDC : Virtual Atomic and Molecular Data Centre (vamdc.org)
B5 commission on Laboratory Astrophysics

WHEN FUSION PLASMAS GET COOL: A NEED FOR MORE ATOMIC PHYSICS IN CLASSICAL FUSION MODELS

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Abstract. Radiative cooling of atomic impurities in tokamak plasmas will have multiple important use cases as envisioned for ITER. For example, a cooled mantle for steady-state tokamak plasma operation, or mitigated post-disruption plasmas which will have a post thermal quench plasma that is cold and has a large population of high-atomic-number impurities. In this second case, runaway electrons, even if they carry the full current, will be of minute density. Standard plasma kinetics tell us that the collisional effect diminishes as the relative speed between two colliding particles increases, but relativistic runaway electrons, at a speed near light speed, can dominate the charge balance in a cold plasma with significant high-Z impurities, despite a density that is 2-4 orders of magnitude smaller than that of background thermal electrons. The underlying cause is found to be the relativistic enhancement of the cross sections for both collisional ionization and excitation, a QED effect known since the seminal work of Møller, Breit, and Bethe. Collisional excitation is found to have a particularly subtle role here, for both radiative cooling and charge state balance. We illustrate this subtle physics through a collisional-radiative model to elucidate the impact on runaway dynamics itself. We explore both steady-state and time-dependent CR evolutions, and outline the implications for accommodating these effects into plasma modeling. The impact of different atomic species and electron distributions is presented. By including the QED effects and with the help of uncertainty quantification, we demonstrate an improved predictive capability and a path forward for in-situ CR modeling of fusion plasma simulations.

MODELLING CONTINUUM ANISOTROPY AND SUPER EDDINGTON ACCRETING QUASAR SPECTRA

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Abstract. Broad emitting line regions (BLR) in the active galaxies are primarily emitted by photoionization processes that are driven by the incident continuum arising from the underlying, complex geometrical structure, i.e. accretion disks, circumscribing the supermassive black hole. Modelling the broad-band spectral energy distribution (SED) effective in ionizing the gas-rich BLR is key to understanding the various radiative processes at play and their importance that eventually leads to the emission of emission lines from diverse physical conditions. Photoionization codes are a useful tool to investigate the two aspects - the importance of the shape of the SED, and the physical conditions in the BLR. In this work, we focus on a long-standing issue pertaining to the anisotropic continuum radiation from the very centres (few 10-100 gravitational radii) of these active galaxies. The anisotropic emission is a direct consequence of the development of a funnel-like structure at regions very close to the black hole due to a marked increase in the accretion rates, in addition to the almost standard disk at larger radii. Incorporating the radiation emerging from such a structure in our photoionization modelling, we are successful in replicating the observed emission line intensities, in addition to the remarkable agreement on the location of the BLR with current reverberation mapping estimates. This study allows us to look at the diversity of the Type-1 active galactic nuclei (AGNs) in the context of the main sequence of quasars, locate the super Eddington sources along the sequence and constrain the physical conditions of their line-emitting BLR. This feat will eventually allow us to use the fascinating super Eddington quasars as probes to understand better the cosmological state of our Universe.