

Colloquium

SFB 956

Conditions and Impact of Star Formation

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Monday 3:30 pm

Physikalische Institute Köln

Lecture Hall III

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Probing the Microphysics of Radiative Feedback from Massive Stars in the James Webb Space Telescope Era

Ultraviolet photons emitted by O/B stars have profound effects on the evolution of interstellar matter in our Galaxy and throughout the Universe, from the era of vigorous star formation at redshifts of 1-3 to the present day. The dominant radiative feedback processes can be probed by observations of the Photo-Dissociation Regions (PDRs) where the far-ultraviolet photons ($E=5.17-13.6$ eV) create warm regions of gas and dust in the neutral atomic and molecular gas. PDR emission provides a unique tool to study in detail the physical and chemical processes that are relevant for most of the mass in inter- and circumstellar media including diffuse clouds, protoplanetary disks and molecular cloud surfaces, globules, planetary nebulae, and star-forming regions.

In this talk, I will present some recent efforts aiming at the improving our understanding of PDRs. I will describe how recent results from laboratory astrophysics providing molecular parameters for Polycyclic Aromatic Hydrocarbons (PAHs) can be used to revisit the role and contribution of these species to the most important heating mechanism in PDRs, i.e. the photoelectric heating. I will then describe the PDRs4All project, which is an Early Release Science (ERS) program involving a large community of scientist from astronomy to laboratory astrophysics, aiming to observe the Orion Bar PDR with the James Webb Space Telescope (JWST) in the summer-fall 2022. Important efforts have been developed by the PDRs4All team, in terms of modelling and data processing methods relying on machine learning, to prepare for the analysis of the spectral images that will be obtained with the NIRSpec and MIRI spectrometers. These data in highly processed format as well as some analysis tools will be made available to the community in the months following the observations, and can be used to address key questions regarding PDR physics and chemistry which I will discuss. These efforts will contribute to a better understanding of the interaction of UV radiation with gas and dust, providing tools for the interpretation of JWST spectra which will be dominated by PDR emission throughout the Universe.