Dries Van De Putte

Curriculum Vitae

October 2023

Phone +1 410 900 5067 **E-mail** dvandeputte@stsci.edu

Skills Profile

- Observational data experience: Writing HST and JWST proposals. Running and adjusting the JWST pipeline for imaging and IFU data, including NIRCam, NIRSpec IFU, MIRI imager, MIRI IFU. Analyzing and decomposing NIRSpec and MIRI data cubes, making maps of both lines and broad emission features (e.g. PAHs). Working with stellar UV spectroscopy from HST STIS and IUE, and a variety of imaging data from HST, JWST, Spitzer, Herschel.
- Development and use of spectral fitting tools: Decomposition of IR spectra into background components, emission lines, and broad features with PAHFIT. Bayesian SED fitting of stellar photometry, to determine stellar properties and dust extinction with the BEAST. Use of statistical techniques to estimate uncertainty and covariance, such as Monte Carlo, bootstrapping, error propagation.
- Development of astrophysical simulations: 3D dust radiative transfer using Monte Carlo techniques. Implementing recipes for the interactions between radiation, dust, and gas, typical of photodissociation region models. Implementing solvers for temperature, simple chemical networks, level populations.
- Computer skills: Collaborative development of Open-Source Python packages, git and GitHub, continuous integration, unit testing. Creating interactive Jupyter notebooks for scientific analysis, and use of various visualization tools, including Glue and JDAViz. Simulation development in C/C++. Using HPC systems, and multi-processing with MPI. Mac/Linux command line tools.

Research Experience

2021-today ■ **Postdoctoral Research Fellow** — Space Telescope Science Institute, Baltimore, MD

- Published Van De Putte et al. (2023): Discovered a linear relationship between the far-UV curvature component of dust extinction curves, and the molecular hydrogen column density. Used UV spectroscopy data from FUSE, HST STIS, and IUE, and existing extinction curve data.
- Worked in the the data reduction team of the PDRs4All collaboration, which observed the Orion Bar with NIRCam and MIRI imaging, and NIRSpec and MIRI IFU spectroscopy (ERS-1288). Maintained a Python package for this team, containing workarounds to resolve issues with early versions of the JWST pipeline. The data reduction team frequently contacted the JWST helpdesk to report and resolve newly discovered issues, and I focused on the NIRSpec and MIRI IFU data. By delivering improved data products, our data reduction team contributed to first four PDRs4All papers (Berné et al. 2023, Habart et al. 2023, Peeters et al. 2023, Chown et al. 2023). Currently leading the fifth PDRs4All paper, containing an overview and initial analysis of the mid-IR emission lines in the Orion Bar.
- Contributed to the open-source spectral decomposition tool PAHFIT. Led the redesign of the main user-facing API, participated in efforts to make PAHFIT compatible with JWST data. Developed a Jupyter notebook which explains the new API and concepts, and presented at JWebbinar 23, the PDRs4ALL community telecons.
- Performed the NIRSpec and MIRI IFU data reduction for the Horsehead and NGC 7023 (GTO-1192). Currently leading a paper for the GTO-1192 collaboration, concerning the decomposition and spatial mapping of spectral features based on the IFU spectra.

2016 - 2020 ■ **PhD of Science in Astronomy** — Ghent University, Ghent, Belgium; Space Telescope Science Institute, Baltimore, MD

- Four year fellowship obtained by submitting a research plan and application to BOF (*bijzonder onderzoeksfonds*), the "exceptional research fund" provided by Ghent University.

- *PhD thesis:* "Self-consistent modelling of radiation, dust, and gas in the interstellar medium". Developed RADAGAST, a new astrophysical C++ code that calculates the local properties of interstellar gas, under the effect of a given local radiation field and dust grain properties, forming a simplified photodissociation region model (see research statement for details). RADAGAST was coupled to SKIRT, a 3D dust radiative transfer code, to enable a self-consistent treatment of the gas, dust, and radiation field in 3D, including all the dust absorption, scattering, and emission details available in SKIRT. Supervision: Maarten Baes, Karl Gordon, Julia Roman-Duval.
- Visited STScI (Apr 2017 - Apr 2018), collaborating with the ISM*@ST group. Published Van De Putte et al. (2020): evidence of dust evolution in the IC 63 photodissociation region, by using a Bayesian stellar and extinction fitting code (BEAST), applied to HST UV and IR photometry. Added stellar distance fitting support to the BEAST code, as well as some tools to better manage its memory usage.
- Teaching assistant for the course "Statistics and data processing" for two semesters (Fall 2018, 2019). Supervised the exercise sessions, and set up three Python programming challenges which introduced the students to essential packages such as *numpy* and *scipy*, and numerical statistical tasks such as error propagation and bootstrapping.

Education

2011 - 2016 ■ **BS and MS in Physics and Astronomy** Ghent University, Ghent, Belgium

- *Master's thesis:* "Data parallelization with MPI in a 3D Monte Carlo dust radiative transfer code". Implemented distributed-data multi-processing in the SKIRT code, making it possible to distribute memory usage across compute nodes. This enabled the user to run models that exceed the memory capacity of a single machine. In the existing C++ code base, I implemented inter-process communications using the industry-standard Message Passing Interface (MPI). Co-authored Verstocken et al. (2017), by including a description of the method. *Supervision:* Maarten Baes.
- *Internship at the Royal Observatory of Belgium:* Developed a new pipeline step for the HERMES spectrograph of the Mercator Telescope. This step, written in Python, removes a bias introduced by the spectrum of the flat-field calibration lamps.
- *Notable elective course:* "Software Development I" in C and C++.

Presentations and Conferences

2023/10/29 – Florence, Italy	*Illuminating the Dusty Universe: A Tribute to the Work of Bruce Draine:* Contributed talk "Spatially resolved maps of the IR emission bands in photodissociation regions"
2023/09/26 – Gothenburg, Sweden	*Origin and Fate of Dust in Our Universe:* Contributed talk "Far-UV extinction and H_2; decomposing and mapping IR bands near the HI-H_2 transition"
2022/12/16 – Remote	*JWebbinar 23: PDRs4ALL Community Telecons in Support of JWST Cycle 2 Proposals; Webinar 3: Tools To Quantify the Spectral Information:* live PAHFIT demo
2022/11/30 – Ghent, Belgium	*SKIRT Days 2022:* Contributed talk about the implementation of the RADAGAST gas model and its use in SKIRT
2022/07/11 – Paris-Saclay, France	*Interstellar Institute #5 - With Two Eyes:* Discuss PDRs4All and PAHFIT
2022/06/12 – Pasadena, CA	*240th Meeting of the American Astronomical Society:* Poster about the far-UV exinction rise to H_2 relationship
2022/03/15 – Baltimore, MD	*STScI Discovery Seminar Series:* "Far-UV Dust Extinction and Molecular Hydrogen in the diffuse Milky Way Interstellar Medium"
2019/06/24 – Lyon, France	*EWASS2019, Cosmic dust (r)evolution:* Poster about IC 63 project
2018/11/05 – Leiden, Netherlands	*Hendrik van Hoof Centennial Symposium:* Poster about IC 63 project
2018/06/11 – Copenhagen, Denmark	*CPHDUST2018: Cosmic Dust: origin, applications & implications:* Poster about IC 63 project

2016/10/28 – Florence, Italy	*DustPedia meeting:* Contributed talk about the parallelization of SKIRT
2016/10/04 – Ghent, Belgium	*CHARM meeting:* Contributed talk about the parallelization of SKIRT

Publications

1. Chown, R., Sidhu, A., Peeters, E., et al. 2023, arXiv e-prints, arXiv:2308.16733 – *PDRs4All IV. An embarrassment of riches: Aromatic infrared bands in the Orion Bar*

2. Habart, E., Peeters, E., Berné, O., et al. 2023, arXiv e-prints, arXiv:2308.16732 – *PDRs4All II: JWST's NIR and MIR imaging view of the Orion Nebula*

3. Berné, O., Martin-Drumel, M.-A., Schroetter, I., et al. 2023, Nature, 621, 56 – *Formation of the methyl cation by photochemistry in a protoplanetary disk*

4. Van De Putte, D., Cartledge, S. I. B., Gordon, K. D., Clayton, G. C., & Roman-Duval, J. 2023, ApJ, 944, 33 – *Far-ultraviolet Dust Extinction and Molecular Hydrogen in the Diffuse Milky Way Interstellar Medium*

5. Berné, O., Habart, É., Peeters, E., et al. 2022, PASP, 134, 054301 – *PDRs4All: A JWST Early Release Science Program on Radiative Feedback from Massive Stars*

6. Van De Putte, D., Gordon, K. D., Roman-Duval, J., et al. 2020, ApJ, 888, 22 – *Evidence of Dust Grain Evolution from Extinction Mapping in the IC 63 Photodissociation Region*

7. Verstocken, S., Van De Putte, D., Camps, P., & Baes, M. 2017, Astronomy and Computing, 20, 16 – *SKIRT: Hybrid parallelization of radiative transfer simulations*

8. Baes, M., Camps, P., & Van De Putte, D. 2017, MNRAS, 468, 927 – *Analytical expressions and numerical evaluation of the luminosity distance in a flat cosmology*