Simon Gazagnes, Ph.D

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Overview

- My research bridges observational data, theoretical models, and computational tools to constrain cosmic reionization and characterize the radiation signatures of galaxies.
- Over the past **7 years**, I published **8 first-author publications** and gave **27 oral presentations** (10 invited) in astrophysics, particle physics, and computer science.
- I have successfully secured ∼**$250,000** in research funds, and my approved proposals span both observational studies and high-performance computing initiatives.

Education

2017-2021 **Ph.D. – Awarded with** *cum laude*.
Data Science & Systems Complexity – University of Groningen (Netherlands).

2016-2017 **Master's degree in Astrophysics, Space science, and Planetary science**
University of Toulouse III (France)

2011-2016 **Double Master's degree in Electrical Engineering and Image and Signal Processing**
National Institute of Applied Sciences of Lyon & University of Lyon I (France)

Research Experience

Ongoing
October 2021
Harlan J. Smith Fellowship, University of Texas at Austin, United States
- Using numerical simulations to interpret astrophysical observations.

September 2021
September 2017
Ph.D., Data Science & Systems Complexity, University of Groningen, Netherlands
Title : Vast and Fast Data in the era of large astrophysics and particle physics experiments.
- Developing pattern recognition tools to deal with large data sets in Astrophysics and fast data sets in Particle physics.

Supervisors : Prof. Nasser Kalantar-Nayestanaki, Prof. Léon V.E. Koopmans, Dr. Johan Messchendorp, Dr. Michael H.F. Wilkinson.

July 2017
March 2017
Research internship, Geneva Observatory, Switzerland
Title : Neutral gas properties of Lyman Continuum Emitters
- Statistical analyses of astrophysical spectra

Supervisors : Prof. John Chisholm, Prof. Daniel Schaerer, Prof. Anne Verhamme

August 2016
February 2016
Research internship, Laboratory I3S, France
Title : Sparse 3D reconstruction for TIRF-PALM Imaging
- Optimization of non convex sparse problems for Biomedical microscopy techniques

Supervisors : Dr. Laure Blanc-Féraud, Dr. Emmanuel Soubies

Awards & Grants

- UT Austin Astronomy Postdoc Excellence Award (2023).
- NASA-HST grant of **$247,344** for the project "Mapping the escape of ionizing photons across the full ionizing continuum using high-resolution Lyman alpha and C IV observations" (2022)
- Harlan J. Smith McDonald Observatory Fellowship – **$10,000** research funds per year (2021 – ongoing).
- Ph.D. awarded with *cum laude* (2021).

Proposals

Astronomical Observations

- HST Cycle 29 – **Principal Investigator** – Mapping the escape of ionizing photons across the full ionizing continuum. **34 orbits** (∼28 hours) of observations
- HST Cycle 29 – Co-Investigator – Tracking down the origin of UV photons in local high-z analogues with FUV emission line imaging. **32 orbits** (∼26 hours) of observations
- HST Cycle 30 – Co-Investigator – Resolving Lyman Alpha emission in a complete sample of Lyman Continuum leakers and non-leakers. **49 orbits** (∼40 hours) of observations

- VLA – Co-Investigator – Disentangling the origin of thermal and non-thermal emission in nearby SFGs. 12.5 h

High-performance clusters

- Frontera (Texas Advanced Computing Center) – **PI** – Radiative Transfer simulations – **5,000 Node Hours**.

Teaching experience

- **Introduction to Computing Science –** Teaching Assistant – Tutorials on inter-cultural communication – 2h per week – 2018 & 2019.
- **Computer Vision –** Teaching Assistant – Tutorials on multiscale analyses, deformable models, mathematical morphology – 2h per week – 2017 & 2018 & 2019.
- **Numerical Methods –** Teaching Assistant – Tutorials on numerical integration, differential equations, minimization problems, applied to astrophysical problems – 2h per week – 2018.
- **Interstellar Medium –** Guest lecturer – Lecture on tools and techniques to infer the Interstellar Medium properties from spectroscopic observations – 1h – 2022.

Supervised students

Aniket Rane	Bachelor Research Project – University of Groningen, 04/20 to 08/20 *Iterative construction of Distributed Component Forests*
Yannis Paetzelt	Bachelor Research Project – University of Groningen, 04/20 to 08/20 *Building the Neighbourhood Relations for Tube Trackers*
Zorayda Martinez	Summer Research Project, University of Texas at Austin, 05/22 to 08/22 *Lyman-alpha properties in CLASSY*, presented at the AAS conference in Seattle.
John Trevino	Bachelor Research Project – University of Texas at Austin, 02/24 to ongoing *Understanding the LyC escape fractions using zoom-in RHD simulations*
Kaelee Parker	Ph.D. Research Project – University of Texas at Austin, 01/23 to ongoing Analyzing UV absorption lines of the CLASSY sample (Parker et al., in prep)

Professional Activities

- Referee for Astronomy & Astrophysics, Monthly Notices of the Royal Astronomical Society, the Astrophysical Journal, and IEEE Transactions on Image Processing.
- Conference organization (Illuminating Galaxy Properties Across Cosmic Times, Iceland 2023)

Open source packages

DISCCOFAN	A C-based image processing tool to analyze the morphological properties of connected structures in gigantic datasets. Massively parallelized using OpenMP and MPI techniques.
LOTF	A ROOT/C++-based algorithm that enables fast-track reconstruction of charged particle trajectories in Straw Tube Trackers.
AbsorpFit	A Python-based package enabling to fit synthetic stellar continuum models, dust attenuation laws, and Voigt absorption profiles to UV spectroscopic observations.
SMLM-CEL0	A Matlab-based algorithm for high-density molecule localization in super-resolution microscopy using a CEL0-based sparse approximation

Talks

27 oral presentations over the past 6 years. 10 most recent (I : invited, C : conference, S : seminar) :

- [I-S] Si II and C II line as tracers of galaxy evolution, University of Minnesota - Twin Cities 02/24
- [I-C] Interpreting UV spectra with RHD simulations, Fake Light workshop, New York, USA 06/23
- [I-C] Interpreting UV spectra with RHD simulations, The JWST turns one, Sesto, Italy 03/23
- [C] Parallel Attribute Computation for Distributed Component Forests, IEEE International Conference on Image Processing (ICIP), France 10/22
- [I-S] Interpreting absorption line spectra with RHD Simulations, Galaxy Seminar, CRAL, Lyon, France 07/22
- [I-S] Track reconstruction in the PANDA Straw Tube Tracker, PANDA Collaboration Meeting (online) 06/22
- [I-C] Lyman-α Properties in CLASSY, Galaxy Evolution Workshop (online) 01/22
- [C] The Morphology of astrophysical structures in Tera-Scale data sets , EAS 2021 (online). 07/21
- [I-S] Distributed Connected Component Filtering and Analysis , Bernoulli Institute seminar (online). 05/21
- [S] Exploring the Properties of the Reionization Sources , CGI Seminar, UC Santa Cruz (online). 11/20

List of Publications – Simon Gazagnes

ORCID : 0000-0002-5659-4974 – Google Scholar. Publications span astrophysical, particle physics, image-processing, and biomedical journals and conferences.

First author

1. **Gazagnes S.**, Chisholm, J., Endsley, R., Berg, D. A., Leclercq, F. – 2024 – Weak LyC escape fraction in two $z \sim 7.5$ galaxies : a possible low contribution of relatively bright galaxies during reionization ? – *To be submitted to MNRAS, private copy of submission version available here*

2. **Gazagnes S.**, Cullen F., Mauerhofer V., Begley, R., and 7 others – 2024 – Comparing the VANDELS sample to a zoom-in Radiative Hydrodynamical Simulation – *The Astrophysical Journal*.

3. **Gazagnes S.**, Mauerhofer V., Berg D., and 19 others – 2023 – Interpreting the Si II and C II line spectra from the COS Legacy Archive Spectroscopic Survey using a virtual galaxy from a high-resolution radiation-hydrodynamic simulation – *The Astrophysical Journal*.

4. **Gazagnes S.**, Kalantar-Nayestanaki N., Messchendorp J. G., and 3 others – 2023 – Reconstructing charged-particle trajectories in the PANDA STT using the LOcal Track Finder (LOTF) algorithm – *European Physical Journal A*.

5. **Gazagnes S.**, Koopmans L. V. E, and Wilkinson M. H. F. – 2021 – Inferring the astrophysics of reionization using the morphological spectra of the ionized regions – *Monthly Notices of the Royal Astronomy Society*.

6. **Gazagnes S.** and Wilkinson M. H. F. – 2021 – Distributed Connected Component Filtering and Analysis – *IEEE Transactions on Image Processing*.

7. **Gazagnes S.**, Chisholm J., Schaerer D., Verhamme A., and Izotov Y. – 2020 – The origin of the escape of Lyman α and ionizing photons in Lyman continuum emitters – *Astronomy & Astrophysics*.

8. **Gazagnes S.** and Wilkinson M. H. F. – 2019 – Distributed component forests in 2D : hierarchical image representations for tera-scale images – *International Journal of Pattern Recognition and Artificial Intelligence*.

9. **Gazagnes S.**, Chisholm J., Schaerer D., and 3 others – 2018 – Neutral gas properties of Lyman continuum emitting galaxies : Column densities and covering fractions from UV absorption lines – *Astronomy & Astrophysics*.

Conference proceedings

9. **Gazagnes S.** and Wilkinson M. H. F. – 2022 – Parallel Attribute Computation for Distributed Component Forests – *Proceedings of the IEEE International Conference on Image Processing (ICIP)*.

10. **Gazagnes S.**, Soubies E., & Blanc-Féraud L. – 2017 – High density molecule localization for super-resolution microscopy using CEL0 based sparse approximation. *Conference proceedings of the 14^{th} IEEE Int. Symposium on Biomedical Imaging*.

Co-authored

11. Gan H., **Gazagnes S.**, Babai M., and Wilkinson M. H. F. – 2024 – Self-Organising Attribute Maps and Pattern Spectra : Novel Explorative Data Analysis Tools for High-Dimensional Vector-Attribute Filtering – *Submitted to IEEE TPAMI, private copy available here*

12. Chisholm, J., Berg, D. A., Endsley, R., **Gazagnes S.**, and 15 others – 2024 – [Ne v] emission from a faint epoch of reionization-era galaxy : evidence for a narrow-line intermediate mass black hole – *ArXiv : 2402.18643*

13. Leclercq, F., Chisholm, J., and 30 others including **Gazagnes S.** – 2024 – Linking Mg II and [O II] spatial distribution to ionizing photon escape in confirmed LyC leakers and non-leakers – *ArXiv : 2401.14981*

14. Weiss, L. H., Davis D., Gebhardt, K., **Gazagnes S.**, and 22 others – 2024 – Absorption Troughs of Lyα Emitters in HETDEX – *The Astrophysical Journal*

15. Mingozzi, M., James, B. L., Berg, D., and 27 others including **Gazagnes S.** – 2024 – CLASSY VIII : Exploring the Source of Ionization with UV ISM diagnostics in local High-z Analogs – *The Astrophysical Journal*

16. Hu, W., Martin C. L., Gronke M., **Gazagnes S.**, and 21 others – 2023 – CLASSY VII Lyα Profiles : The Structure and Kinematics of Neutral Gas and Implications for LyC Escape in Reionization-Era Analogs – *The Astrophysical Journal*

17. Saxena, A., Cole A., **Gazagnes S.**, Meerburg P. D., Weniger C., Witte S. J. – 2023 – Constraining the X-ray heating and reionization using 21-cm power spectra with Marginal Neural Ratio Estimation – *Monthly Notices of the Royal Astronomy Society*.

18. Saldana-Lopez A., Schaerer D., and 25 others, including **Gazagnes S.** – 2022 – The Low-Redshift Lyman Continuum Survey : unveiling the ISM properties of low-z Lyman continuum emitters – *Astronomy & Astrophysics*.

19. Chisholm J., Prochaska X., Schaerer D., **Gazagnes S.**, Henry A. – 2020 – Optically thin spatially resolved Mg II emission maps the escape of ionizing photons – *Monthly Notices of the Royal Astronomy Society*.

20. Ghara R., Giri S.K., Mellema G., and 19 others, including **Gazagnes S.** – 2020 – Constraining the intergalactic medium at z$\approx$ 9.1 using LOFAR Epoch of Reionization observations – *Monthly Notices of the Royal Astronomy Society*.

21. Mertens F. G., Mevius M., Koopmans L. V. E., and 23 others, including **Gazagnes S.** – 2020 – Improved upper limits on the 21 cm signal power spectrum of neutral hydrogen at z $\approx$ 9.1 from LOFAR – *Monthly Notices of the Royal Astronomy Society*.

22. Chisholm J., **Gazagnes S.**, Schaerer D., and 6 others – 2018 – Accurately predicting the escape fraction of ionizing photons using rest-frame ultraviolet absorption lines – *Astronomy & Astrophysics*.