



Léontine Ségal

Soon to be Ph.D. looking for a post-doc.

Telephone number: 06 11 87 33 90 * *Date of birth:* 07-11-1999 (Paris)

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I am a 3rd Ph.D. student at the Institut de Radioastronomie Millimétrique (IRAM, Grenoble) and at the IM2NP (Toulon). My research is carried out as part of the ORION-B consortium (DAOISM ANR-21-CE31-0010), and focuses on the development of statistical techniques to process radio emissions from molecules that compose the InterStellar Medium (ISM). I would like to continue developing my statistical learning skills in signal processing and real data analysis oriented toward physical applications.

Experience

Ph.D. in statistical learning applied to the analysis of the ISM

Sept. 2022 - Today

IM2NP & Institut de Radioastronomie millimétrique (IRAM)

Toulon & Grenoble

Thesis title: *Quelle est la robustesse sur l'estimation des caractéristiques physico-chimiques des nuages moléculaires interstellaires en l'absence de vérité terrain ?*

PH.D. supervisors: Antoine Roueff (antoine.roueff@univ-tln.fr) & Jérôme Pety (pety@iram.fr).

Based on statistical theory tools (e.g., Craméro-Rao bound), I co-developed a new methodology to infer fields of the ISM's properties (e.g., kinetic temperature, volume density of H₂, kinematics) toward heterogeneous regions (e.g., dense cores, filaments) from multi-molecular datasets.

Key words: *Estimation theory, model inversion, interstellar medium (ISM), rotational spectroscopy, radiative transfer theory, chemical abundances, calibration noise.*

Main publications:

- Ségal, L. *et al.* (2024). “Toward a robust physical and chemical characterization of heterogeneous lines of sight: The case of the Horsehead nebula”. In: *Astronomy & Astrophysics* 692, A160. doi: 10.1051/0004-6361/202451567
- Roueff, A. *et al.* (2024). “Bias versus variance when fitting multi-species molecular lines with a non-LTE radiative transfer model - Application to the estimation of the gas temperature and volume density”. In: *Astronomy & Astrophysics* 686, A255. doi: 10.1051/0004-6361/202449148
- Ségal, L. *et al.* (2025) “De la possibilité d'ignorer un bruit de calibration lors de la construction d'un estimateur du maximum de vraisemblance en radio-astronomie”. GRETSI 2025 conference with proceedings. [link to the paper](#).

Engineering school end-of-studies internship

Feb. 2022 – July 2022

Institut Fresnel

Marseille

Supervisors: Antoine Roueff

Statistical analysis & signal processing for radio observations.

Research engineer internship

May 2021 – August 2021

Institut de planétologie et d'astrophysique de Grenoble (IPAG)

Grenoble

Supervisors: Mickaël Bonnefoy & Anne-Marie Lagrange

Hyperspectral data analysis for exoplanet detection through the case of the β Pictoris system.

Education

PHELMA Ecole nationale supérieure de physique, électronique, matériaux *Sept. 2019 - Feb. 2022*
Engineer's degree in Signal and Image processing, Communication systems, Multimedia *Grenoble*
see website

Major fields: Signal and image processing, real-time processing, filtering and frequency analysis, geoscience and remote sensing, geophysical and astrophysical signal, wavelet analysis, estimation and detection theory.

CPGE MPSI-PSI *2017 - 2019*
Lycée Jeanne d'Albret *Saint-Germain-en-Laye*
Mathematics, Physics and Engineering sciences.

Baccalauréat S - Spécialité SVT *2017*
Lycée La Bruyère *Versailles*
Mention TB. Coursus à horaires aménagés musique (violon)

Teaching at the Université de Toulon (84 HETD, 2023-2025)

Mécanique statique (TD)	L1 Sciences de l'ingénieur, 30 HETD
Mathématiques pour l'informatique (TP)	L1 Informatique, 24 HETD
Calcul Numérique (TP)	L1 Sciences de l'ingénieur, 18 HETD
Architecture des ordinateurs (TD)	L1 Sciences de l'ingénieur, 12 HETD

Technical skills

Programming Languages	Python, Matlab, C, C++, Java, VHDL
Tools	L ^A T _E X, Git, Visual Studio Code, vim

Language proficiencies

French	Mother tongue
English	C1 (Linguaskill certification obtained at PHELMA in 2021)
Russian	B1, 2 nd language at high school and engineering school

Hobbies

Creative activities	Embroidery, drawing
Sport	Ultimate frisbee, hiking and camping, climbing

Conference talks without proceedings

- Colloque du Programme Physique Chimie du Milieu Interstellaire (PCMI), Bordeaux (France), October 2024. "Towards robust estimations of molecular cloud physical conditions from multi-species lines: The case of the Horsehead nebula". Contributed talk.
- 53rd Young European Radio Astronomers Conference (YERAC), Madrid (Spain), September 2024. "A statistical approach to infer molecular cloud conditions from multi-molecular lines analysis of Horsehead nebula observations". Brief talk.

Seminar presentations and workshops

- Atelier sur les méthodes IA et ML en astrophysique pour l'analyse du milieu interstellaire, Bordeaux (France), October 2024. Contributed talk.
- GDR IASIS, État des lieux des méthodes d'inversion en astronomie et challenges à venir, Gif-sur-Yvette (France), June 2024. "Analyse multi-espèces du milieu interstellaire fondée sur les observations millimétriques de la nébuleuse de la Tête de Cheval". Contributed talk.
- ORION-B/DAOISM workshops (France). Every 9 months, the consortium's members gather to share our progress. LERMA, Paris, June 2022, January 2023; CRISAL, Lille, July 2023; IRAM, Grenoble, January 2024; IRAP, Toulouse, July 2024; IM2NP, Toulon, January 2025; LUX, Paris, April 2025.

Other publications in international journals as co-author (minor contributions)

- Palud, P. *et al.* (2025). "BEETROOTS: Spatially regularized Bayesian inference of physical parameter maps. Application to Orion". In: *Astronomy & Astrophysics* 698, A311. doi: 10.1051/0004-6361/202554266
- Zakardjian, A. *et al.* (2025). "Understanding spatially unresolved measurements of molecular line emission". In: *Astronomy & Astrophysics* 696, A165. doi: 10.1051/0004-6361/202451104
- Einig, L. *et al.* (2024). "Quantifying the informativity of emission lines to infer physical conditions in giant molecular clouds - I. Application to model predictions". In: *Astronomy & Astrophysics* 691, A109. doi: 10.1051/0004-6361/202451588
- Santa-Maria, M. G. *et al.* (2023). "HCN emission from translucent gas and UV-illuminated cloud edges revealed by wide-field IRAM 30 m maps of the Orion B GMC - Revisiting its role as a tracer of the dense gas reservoir for star formation". In: *Astronomy & Astrophysics* 679, A4. doi: 10.1051/0004-6361/202346598
- Palud, P. *et al.* (2023). "Neural network-based emulation of interstellar medium models". In: *Astronomy & Astrophysics* 678, A198. doi: 10.1051/0004-6361/202347074
- Zakardjian, A. *et al.* (2025). "Estimating the dense gas mass of molecular clouds using spatially unresolved 3 mm line observations". (submitted *Astronomy & Astrophysics*)
- Bešlić, I. *et al.* (2025). "Tracers of the ionization fraction in dense and translucent molecular gas: II. Using mm observations to constrain ionization fraction across Orion B". (submitted *Astronomy & Astrophysics*)