4. CV of the researcher

Personal Information

Family name, First name : Renaud, Ophélie
Date of birth : 28/08/1998
Contact : ophelie4.renaud@orange.fr

0009-0002-3336-8867 Google Scholar profile ResearchGate profile
LinkedIn profile Github project Personal website

Research Areas

- High-Performance Computing
- Rapid Prototyping
- Dataflow Programming
- Resource Allocation Optimization
- Simulation
- Radio-interferometric imaging pipelines

Dr. Ophélie Renaud's research addresses the challenges of high-performance computing (HPC) systems by optimizing resource usage, improving software productivity, and advancing the co-design of architectures and applications. She presents methods for optimizing resource allocation in multi-core processors, distributing resources across heterogeneous processors, and identifying optimal topologies for HPC applications. These contributions have been implemented in the rapid prototyping tool PREESM and are part of the development of the SimSDP co-simulator for radio astronomy. Her current post-doctoral research focuses on the automatic exploration of radio-interferometric imaging algorithms and the optimization of HPC architectures.

Education

PhD *2021–2024* — Univ Rennes, INSA Rennes, CNRS, IETR
Specialization : *Signal, Image, Vision*
Thesis Title : *Granularity Optimization Based on a Model for High-Performance Computing Systems in Astronomy*
Supervisors : *Jean-François Nezan (Supervisor) and Karol Desnos (co-supervisor)*

Engineering Degree *2018–2021* — INSA Rennes
Specialization : *Electronics – Design and Development of Innovative Technologies in Work-Study Program*
Project : *Digital Vision in Robotic Welding*
Supervisors : *Florent Hodiesne (Work-study Mentor) and Philippe Menke (Academic Tutor)*

DUT (University Technology Diploma) *2016–2018* — University of Rennes
Specialization : *Electrical Engineering and Industrial Computing*

High School Diploma *2016* — F.R. Chateaubriand High School, Combourg
Series : *Scientific*
Section : *European Spanish*
Area : *Physics*
Distinction : *Swimming*
Mention : *With Honors*

Employment

Postdoctoral Researcher *October 2024–March 2026* IRISA, ENS Rennes, SATIE Paris-Saclay, France
Modeling dataflow applications for radioastronomical observatories. Optimization of radio imaging algorithms using AAM (Algorithm-Architecture Matching) optimization techniques, and participation in the NenuFar project to enhance data processing performance.

Visiting PhD Researcher *April 2024* Swinburne University, Melbourne, Australia
Collaboration with astronomers at Swinburne University as part of the RISE International Network for Solutions Technologies and Applications of Real-time Systems (Rising STARS). Dataflow modeling of a correlator as a case study for an automatic resource allocation method on heterogeneous CPU-GPU systems.

Visiting PhD Researcher *July–August 2023* CSIRO, Sydney, Australia
Collaboration with astronomers at CSIRO as part of the RISE International Network for Solutions Technologies and Applications of Real-time Systems (Rising STARS). Dataflow modeling of a radio frequency interference (RFI) filter as a case study for an automatic resource allocation method on HPC systems.

PhD Researcher *2021–2024* Univ Rennes, INSA Rennes, CNRS, IETR, France
Research on resource optimization for high-performance computing systems in astronomy. Development of methods for efficient data stream management in the SKA (Square Kilometre Array) project, integrating parallelization models and workload distribution.

Founder & Designer *2019–2023* AQUA-FIN, France
Design of swimming equipment with fins for competition using 3D printing and development of electronic systems.

Application Engineer Apprentice *July–August 2020* YASKAWA, Slovenia
Development of programs for industrial automation and human-machine interfaces (HMIs). Contribution to the implementation of an automated system to improve production performance in industrial robotics.

Application Engineer Apprentice *2018–2021* YASKAWA, France
Development of software and automation solutions for industrial robotic systems. Programming of PLCs and HMIs, and implementation of software for production and automated equipment management.

Robotics Technician Intern *April–June 2018* YASKAWA, France
Participation in the development of human-machine interfaces (HMIs) for managing industrial robots. Assisting teams in integrating new technologies into existing systems.

Lifeguard *Summer 2017 and 2018* SNSM, France
Responsible for beach and swimming surveillance. Providing emergency first aid and managing risky situations. Coordinating rescue team interventions to ensure the safety of individuals.

Electrical Technician Intern *March 2013* COBAC, France
Assisting with electrical installations and customer relations.

Educational Activities

Colloquium / Seminar / Lecture

SORS seminar *July 2025* BSC-CNS, Barcelona
Toward Automated Static-Dynamic Co-Design for Real-Time Radio Astronomy on Heterogeneous HPC. Presentation link

ICR seminar *January 2025* ICR working group, France
SimSDP : Proof of Concept for Radio Astronomy Imaging on High-Performance Architectures.

MAGELLAN seminar *November 2024* IRISA, France
Optimizing Radio Astronomy Imaging Algorithms on HPC Systems with SimSDP and Fine-Grained Descriptions.

VAADER seminar *November 2024* INSA, IETR, France
Automated Deployment of Radio Astronomy Pipeline on CPU-GPU Processing Systems : DiFX as a Case Study. Presentation link

ATNF, CSIRO colloquium *May 2024* Swinburne University and CSIRO, Australia
Design and programming of heterogeneous and high-performance computing systems in astronomy. Presentation link

VAADER reading group *November 2023* INSA, IETR, France
Energy-efficient and High-throughput CNN Inference on Embedded CPUs-GPUs MPSoCs. Presentation link

Green seminar *October 2023* INSA, IETR, France
Design and programming of low power and high performance computing systems in astronomy.

VAADER seminar *October 2023* INSA, IETR, France
SCAPE : HW-Aware Clustering of Dataflow Actors for Tunable Scheduling Complexity. Presentation link

ATNF, CSIRO colloquium *August 2023* CSIRO, Australia
Design and programming of heterogeneous and high-performance computing systems in astronomy. Presentation link

VAADER reading group *March 2023* INSA, IETR, France
Automatically Scheduling Halide Image Processing Pipelines. Presentation link

Contest

Hackathons ECLAT *february-june-october 2025* Paris Observatory, France
Distributed measurementSet simulation.

3MT contest *August 2024* 32nd European Signal Processing Conference (EUSIPCO), France
Presentation link

My PhD in 180 Seconds *May 2024* National competition, departmental finalist, France
Presentation link

Supervision

Supervisor for Master's Thesis Project *February–August 2024* INSA, IETR, Swinburne University
Mentored a master's student internship on automatic resource allocation and optimized code for CPU-GPU systems using the DiFX correlator in radio astronomy pipelines, in collaboration with Australian astronomers, as part of the Rising STARS project.

Teaching

Communication Bus Practical Sessions *November–December 2023* INSA Rennes
BAC+4 : *20 hours*
This module covers the CAN protocol, where students used CubeMX and Keil to configure communication, handle frames, and manage interruptions.

Parallel Programming on Embedded MPSoCs Practical Sessions *October 2023* INSA Rennes
BAC+5 : *12 hours*
This module covers parallel programming for embedded MPSoCs using PThreads, OpenMP, and PREESM, with a project on parallelism and performance optimization.

C Language Project Supervision *2021 - 2022* INSA Rennes
BAC+4 : *16 hours*
This module covers C projects, focusing on design, coding, testing, best practices, Git, and documentation to build programming and teamwork skills.

Mathematics Tutoring *2020 - 2021*
9-10th Grade : *14 hours*
Tutored 9th and 10th-grade students in mathematics, providing concept explanations, exercises, and personalized support.

Online Tutorials

DFT/FFT/G2G tutorial for beginner *2025* DARK ERA
Basics of spectral transforms for NenuFAR imaging. Tutorial link

DDFacet tutorial for beginner *2025* Labcom ECLAT
Advanced LOFAR imaging with DDFacet. Tutorial link

CPU-GPU Design Space Exploration *2024* PREESM website
Optimization techniques for GPU-accelerated systems. Tutorial link

SimSDP : Multinode Design Space Exploration *2024* PREESM website
Multinode rapid prototyping for HPC architectures. Tutorial link

SCAPE Clustering *2024* PREESM website
Clustering for efficient multicore dataflow execution. Tutorial link

Online Application

MeasurementSet simulator *2024*
Synthetic interferometric data generation for distributed benchmark. Application link

Distributed Generic Imaging Pipeline *2024*
Dataflow-based radio-interferometric imaging pipeline for distributed systems. Application link

MAD-based RFI filter *2023*
Dataflow-based MeerKAT radio frequency interference pipeline. Application link

Research Grants

- Marie Skłodowska-Curie Fellowship under the European Union's Horizon 2020 research and innovation program, grant agreement No 873120.
- DARK-ERA (ANR-20-CE46-0001-01), funded by the French National Research Agency (ANR).

Publications

– **Ophélie Renaud**, Adrien Gougeon, Karol Desnos, Chris Phillips, John Tuthill, Martin Quinson, and Jean-François Nezan, *SimSDP : Automatic Workload-Balancing on Multi-Node & Multi-Core HPC Architectures based on dataflow models,* under review at IEEE Transaction on Parallel and Distributed Systems (TPDS) journal.

2025 **Ophélie Renaud**, Nicolas Gac, François Orieux, and Cédric Viou, *SimSDP, a Rapid Prototyping tool for Radio Astronomy : From NenuFAR Experiments to SKAO-Scale Simulation,* accepted at IEEE Workshop on Signal Processing Systems (SiPS).

2025 **Ophélie Renaud**, Sunrise wang, Nicolas Gac, *Extension du prototypage rapide pour les pipelines d'imagerie radioastronomique : Simulation avancée multi-nœud HPC,* at Groupe de Recherche et d'Etudes de Traitement du Signal et des Images (GRETSI) conference. Publication link

2025 Ewen Michel, **Ophélie Renaud**, Karol Desnos, Adam Deller, Chris Phillips, and Jean-François Nezan, *Automated Deployment of Radio Astronomy Pipeline on CPU-GPU Processing Systems : DiFX as a Case Study,* in the 34th Astronomical Data Analysis Software and Systems (ADASS) conference. Publication link

2024 **Ophélie Renaud**, *Model Based Granularity Optimization for High Performance Computing Systems in Astronomy,* Thesis. Publication link

2024 **Ophélie Renaud**, Hugo Miomandre, Karol Desnos, and Jean-François Nezan, *Automated Level-Based Clustering of Dataflow Actors for Controlled Scheduling Complexity,* in the Journal of Systems Architecture (JSA). Publication link

2024 **Ophélie Renaud**, Erwan Raffin, Karol Desnos, and Jean-François Nezan, *Multicore and Network Topology Codesign for Pareto-Optimal Multinode Architecture,* in the 32nd European Signal Processing Conference (EUSIPCO). Publication link

2023 **Ophélie Renaud**, Naouel Haggui, Karol Desnos, and Jean-François Nezan, *Automated Clustering and Pipelining of Dataflow Actors for Controlled Scheduling Complexity,* in the 31st European Signal Processing Conference (EUSIPCO). Publication link

2023 **Ophélie Renaud**, Dylan Gageot, Karol Desnos, and Jean-François Nezan, *SCAPE : Regroupement d'Acteurs flux de Données en Fonction de l'Architecture pour une Complexité d'Ordonnancement Contrôlée,* at Groupe de Recherche et d'Etudes de Traitement du Signal et des Images (GRETSI) conference. Publication link

2023 **Ophélie Renaud**, Dylan Gageot, Karol Desnos, and Jean-François Nezan, *SCAPE : HW-Aware Clustering of Dataflow Actors for Tunable Scheduling Complexity,* in the Design and Architecture for Signal and Image Processing (DASIP) conference. Publication link

Other information

Programming languages

Python, C, C++, JAVA, CUDA, bash, HTML.

Target architectures

Grid5000 cluster, Ruche mesocentre cluster, Nancep cluster, CPU, GPU, PYNQ-Z2, SLURM, OAR.

Languages

French (Native) English (B2 - TOEIC) Spanish (B2 - DELE)

Leisure

Swimming, fin swimming, triathlon, marathon, swimrun, climbing, 3D printing, Aqua-Fin.