Learned Imaging and Wireless Communication with Reconfigurable Intelligent Surfaces

About the group

Our group specializes in molding the flow of information through tailored wave-matter interactions, with an experimental focus on applied electromagnetics. Imaging and wireless communication underpin countless modern and futuristic applications (autonomous vehicles, smart environments, energy-efficient secure communication) and rely on waves to carry information. Our primary interests are in programming the properties of the matter with which these waves interact to enable a smooth transfer of information even under very hostile conditions, and to streamline this programming with an intelligent data analysis. Our experimental workhorse for tailoring wave-matter interactions are programmable metasurfaces – ultrathin arrays of meta-atoms with individually controllable scattering properties that have a unique capability to manipulate electromagnetic fields in a reprogrammable manner. We leverage concepts from wave physics, metamaterial engineering and artificial intelligence to conceive and prototype ideas for deploying such "reconfigurable intelligent surfaces" (RIS) to address fundamental problems (energy efficiency, security, operation under challenging conditions) in imaging and wireless communication. Take a look at our website to learn more!

What are you going to do?

- Design and prototype novel approaches to low-lateny energy-efficient imaging and wireless communication.
- Perform radio-frequency experiments leveraging a programmable metasurface as RIS.
- Implement AI-driven data analysis pipelines.
- Present your results at international conferences.
- Work closely with our international collaborators on joint projects (short term visits can be arranged).

What do we require?

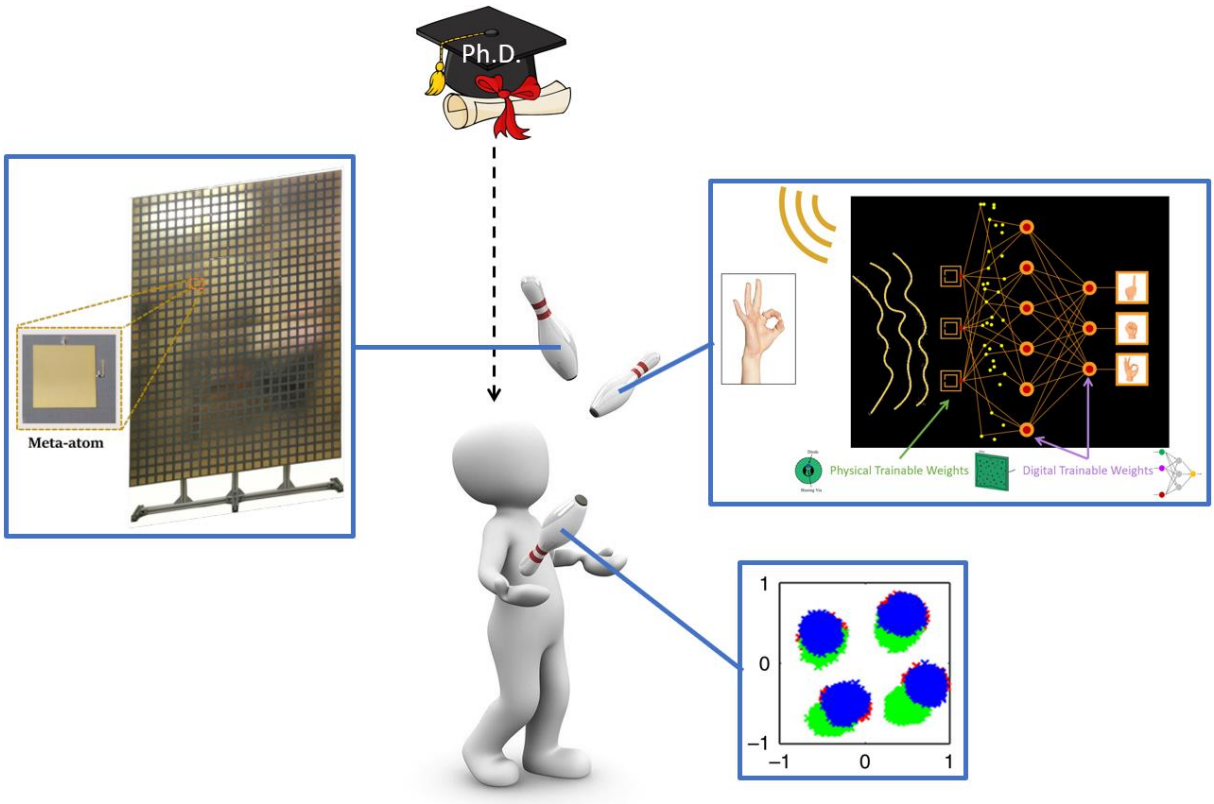
- High level of motivation, passion, curiosity and perseverance.
- Strong background in (wave) physics or electrical engineering.
- Enjoy working in an international, fast-paced and collaborative team environment.

Preferred Skills and Experience:

- Previous experience with basic microwave measurement devices (VNAs, etc.).
- Previous experience with scientific software (Python, MatLab, etc.).
- Knowledgeable about machine learning techniques.
- Excellent written and oral communication skills in English.

Our offer:

- 3-year full-time employment with a fully funded doctoral contract. Remuneration according to French standards for doctoral candidates.
- Affiliation with Institut d'Électronique et des Technologies du numéRique (IETR) – Université de Rennes 1 and CNRS.
- Starting date in fall 2021 (flexible).
- Gain experience with cutting-edge experimental radio-frequency equipment.
- Pioneer new RIS-enabled ideas for imaging and wireless communication.
- Collaborate with an international network of renown experts.
- Present at key international conferences.
- Assistance with faculty teaching can be arranged but is not mandatory.



If you recognize yourself in this job profile, please submit your application that includes

- Motivation letter (why do you want to join our group?).
- Detailed CV.
- PDF version of your MSc thesis (or an abstract if the thesis is not yet finalized).
- Name and contact information of at least one referee whom we can contact to request a recommendation letter.

to

Dr. Philipp del Hougne
Email: philipp.delhougne@gmail.com

Dr. Matthieu Davy
Email: matthieu.davy@univ-rennes1.fr

We welcome inquires for additional information via email.

Applications are evaluated on a rolling basis. We are commited to diversity and strongly encourage applications from underrepresented groups.

[1] del Hougne, P., Imani, M. F., Diebold, A. V., Horstmeyer, R., & Smith, D. R. (2020). Learned integrated sensing pipeline: Reconfigurable metasurface transceivers as trainable physical layer in an artificial neural network. *Advanced Science*, 7(3), 1901913.

[2] Li, H. Y., Zhao, H. T., Wei, M. L., Ruan, H. X., Shuang, Y., Cui, T. J., del Hougne, P. & Li, L. (2020). Intelligent Electromagnetic Sensing with Learnable Data Acquisition and Processing. *Patterns*, 1(1), 100006.

[3] Zhao, H., Shuang, Y., Wei, M., Cui, T. J., del Hougne, P., & Li, L. (2020). Metasurface-assisted massive backscatter wireless communication with commodity Wi-Fi signals. *Nature Communications*, 11(1), 1-10.

[4] F. Imani, M., Smith, D. R., & del Hougne, P. (2020). Perfect Absorption in a Disordered Medium with Programmable Meta-Atom Inclusions. *Advanced Functional Materials*, 2005310.