Rémi Helleboid, Ph.D. Student
Computational Nanoelectronics Researcher

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Employment History

2021 – 2024	🔖 **PhD Student** With **C2N**, University Paris Saclay, CNRS, France, **CEA LETI**, Grenoble, France, and **STMicroelectronics**, Crolles, France.
2020	🔖 **Intern** - **STMicroelectronics** Advanced Modeling for 3D Single-Photon Avalanche Diode TCAD Simulation.

Education

2021 –	🔖 **PhD, C2N, Université Paris Saclay, CNRS** Nanoelectronics Department. Thesis title: *Modelling and optimization of Ge-based Single Photon Avalanche Diodes*
2019-2020	🔖 **M.Sc. Mathematics, Sorbonne Univeristé** Numerical Methods and High Performance Scientific Computing. Graduated with *High honors, 70/100.*

Skills

Languages	🔖 Native French speaker. English fluent.
Coding	🔖 C++ (advanced), Python (advanced), Julia (Strong), MatLab (Basics).
Core skills	🔖 Numerical methods (PDE solvers: FD, FEM), Monte Carlo methods. Single-Photon Avalanche Diode: Architecture and simulation.
Tools	🔖 Synopsys tools: SWB, SProcess, SDevice. Quantum Espresso: pw.x, ph.x, epw.x.

Projects

Code project

2021 –	🔖 **Armin**, C++ Project for Advection-Diffusion Monte Carlo on 3D Nanoscale Devices. OpenMP Parallelization, CI/CD with Github Action.
2022 –	🔖 **BzBandDos**, Empirical Pseudopotential applied to Electronic Band Structure computation on Unstructured Mesh of the Brillouin Zone. Featuring computation of the Electronic Density of State and Dielectric constant. MPI Parallelization.
2020 –	🔖 **UTOX**, Full-Band Monte Carlo C++ Project for Bulk and 3D Device simulation of carriers transport and impact ionization in Si, Ge, and SiGeC alloys. Development of new techniques, including Octrees for wave vector localization in the Brillouin Zone's mesh, and particle localization in the device's mesh.

Academic Projects

2020 –	🔖 **MUNDFAB Project**. EU Horizon 2020 project aiming at *Modeling Unconventional Nanoscaled Device FABrication*. Important contribution to the Work Package 6: Tool chain of simulators for unconventional process simulation of transistors.

Projects (continued)

2021 –   ▉ **ANR GeSPAD**. French ANR Project devoted to achieve a major breakthrough in the development of the next-generation of Single Photon Avalanche Diodes (SPAD).

References

Available on request

Research Publications

Journal Articles

1. Cazimajou, T., Pala, M., Saint-Martin, J., **Helleboid, R.**, Grebot, J., Rideau, D., Dollfus, P., "Quenching Statistics of Silicon Single Photon Avalanche Diodes". In: *IEEE Journal of the Electron Devices Society* 9 (2021). Conference Name: IEEE Journal of the Electron Devices Society, pp. 1098–1102. ISSN: 2168-6734. DOI: 10.1109/JEDS.2021.3127013.

2. Dollfus, P., Saint-Martin, J., Cazimajou, T., **Helleboid, R.**, Pilotto, A., Rideau, D., Bournel, A., Pala, M. G., "Avalanche breakdown and quenching in Ge SPAD using 3D Monte Carlo simulation". In: *Solid-State Electronics* 194 (2022), p. 108361. DOI: 10.1016/j.sse.2022.108361. (Visited on 05/06/2023).

3. **Helleboid, R.**, Rideau, D., Grebot, J., Nicholson, I., Moussy, N., Saxod, O., Basset, M., Zimmer, A., Mamdy, B., Golanski, D., Agnew, M., Pellegrini, S., Sicre, M., Buj, C., Marchand, G., Saint-Martin, J., Pala, M., Dollfus, P., "Comprehensive Modeling and Characterization of Photon Detection Efficiency and Jitter Tail in Advanced SPAD Devices". In: *IEEE Journal of the Electron Devices Society* 10 (Jan. 1, 2022), pp. 1–1. DOI: 10.1109/JEDS.2022.3168365.

4. **Helleboid, R.**, Rideau, D., Grebot, J., Nicholson, I., Moussy, N., Saxod, O., Saint-Martin, J., Pala, M., Dollfus, P., "Modeling of SPAD avalanche breakdown probability and jitter tail with field lines". In: *Solid-State Electronics* 194 (May 1, 2022), p. 108376. DOI: 10.1016/j.sse.2022.108376.

5. **Helleboid, R.**, Rideau, D., Nicholson, I., Grebot, J., Mamdy, B., Mugny, G., Basset, M., Agnew, M., Golanski, D., Pellegrini, S., Saint-Martin, J., Pala, M., Dollfus, P., "A Fokker-Planck-based Monte Carlo method for electronic transport and avalanche simulation in single-photon avalanche diodes". In: *Journal of Physics D: Applied Physics* 55 (Oct. 19, 2022). DOI: 10.1088/1361-6463/ac9b6a.

Conference Proceedings

1. Grebot, J., Mugny, G., **Helleboid, R.**, Nicholson, I., Abbate, F., Rideau, D., Wehbe-Alause, H., Scheid, C., Lanteri, S., "Semi-Empirical model for optical properties of $\text{Si}_{1-x}\text{Ge}_x$ alloys accounting for strain and temperature". In: *ESSDERC 2021 - IEEE 51st European Solid-State Device Research Conference (ESSDERC)*. ESSDERC 2021 - IEEE 51st European Solid-State Device Research Conference (ESSDERC). Sept. 2021, pp. 267–270. DOI: 10.1109/ESSDERC53440.2021.9631823.

2. **Helleboid, R.**, Rideau, D., Nicholson, I., Moussy, N., Saxod, O., Basset, M., Grebot, J., Zimmerman, A., Mamdy, B., Golanski, D., Agnew, M., Pellegrini, S., Sicre, M., "Comprehensive modeling and characterization of Photon Detection Efficiency and Jitter in advanced SPAD devices". In: *ESSDERC 2021 - IEEE 51st European Solid-State Device Research Conference (ESSDERC)*. ESSDERC 2021 - IEEE 51st European Solid-State Device Research Conference (ESSDERC). Sept. 2021, pp. 271–274. DOI: 10.1109/ESSDERC53440.2021.9631801.

3   Rideau, D., Oussaiti, Y., Grebot, J., **Helleboid, R.**, Lopez, A., Mugny, G., Bourreau, E., Golanski, D., Mamdy, B., Alause, H. W., Nicholson, I., Pellegrini, S., Vlimant, C., Agnew, M., Cazimajou, T., Pala, M., saint-martin, J., Dollfus, P., "Single Photon Avalanche Diode with Monte Carlo Simulations: PDP, Jitter and Quench Probability". In: *International Conference on Simulation of Semiconductor Processes and Devices (SISPAD 2021)*. Dallas, United States: , Sept. 27-29, 2021, Virtual conference Dallas, US, Sept. 2021. ⚲URL: https://hal.archives-ouvertes.fr/hal-03374008 (visited on 02/08/2022).

4   Sicre, M., Agnew, M., Buj, C., Coignus, J., Golanski, D., **Helleboid, R.**, Mamdy, B., Nicholson, I., Pellegrini, S., Rideau, D., Roy, D., Calmon, F., "Dark Count Rate in Single-Photon Avalanche Diodes: Characterization and Modeling study". In: Pages: 146. Sept. 13, 2021. ⚲DOI: 10.1109/ESSDERC53440.2021.9631797.

5   Saint-Pierre, D., Clerc, R., **Helleboid, R.**, Rideau, D., "On the convergence of the recurrence solution of McIntyre's local and non-local avalanche triggering probability equations for SPAD compact models". In: *ESSDERC 2022 - IEEE 52nd European Solid-State Device Research Conference (ESSDERC)*. ESSDERC 2022 - IEEE 52nd European Solid-State Device Research Conference (ESSDERC). Sept. 2022, pp. 277–280. ⚲DOI: 10.1109/ESSDERC55479.2022.9947121.

6   Sicre, M., Agnew, M., Buj, C., Coutier, C., Golanski, D., **Helleboid, R.**, Mamdy, B., Nicholson, I., Pellegrini, S., Rideau, D., Roy, D., Calmon, F., "Statistical measurements and Monte-Carlo simulations of DCR in SPADs". In: *ESSCIRC 2022- IEEE 48th European Solid State Circuits Conference (ESSCIRC)*. ESSCIRC 2022- IEEE 48th European Solid State Circuits Conference (ESSCIRC). Sept. 2022, pp. 193–196. ⚲DOI: 10.1109/ESSCIRC55480.2022.9911519.

7   **Helleboid, R.**, Saint-Martin, J., Pala, M., Dollfus, P., Rideau, D., Mugny, G., Nicholson, I., Grebot, J., "Automatic optimization of doping profile for high performance Single-Photon Avalanche Diodes". In: *International Workshop on Computational Nanotechnology - IWCN 2023*. International Workshop on Computational Nanotechnology - IWCN. 2023.

8   Rideau, D., **Helleboid, R.**, Mugny, G., Bianchi, R. A., Manouvrier, J. R., Nicholson, I., Grebot, J., Lacombe, E., Lopez, A., Golanski, D., Mamdy, B., Rae, B., Pellegrini, S., Agnew, M., Uhring, W., Rink, S., Alause, H. W., "Multiscale SPAD modeling: from Monte Carlo to SPICE simulations". In: *Advanced Photon Counting Techniques XVII*. Advanced Photon Counting Techniques XVII. Vol. 12512. SPIE, June 15, 2023, pp. 10–15. ⚲DOI: 10.1117/12.2665099. (Visited on 08/09/2023).