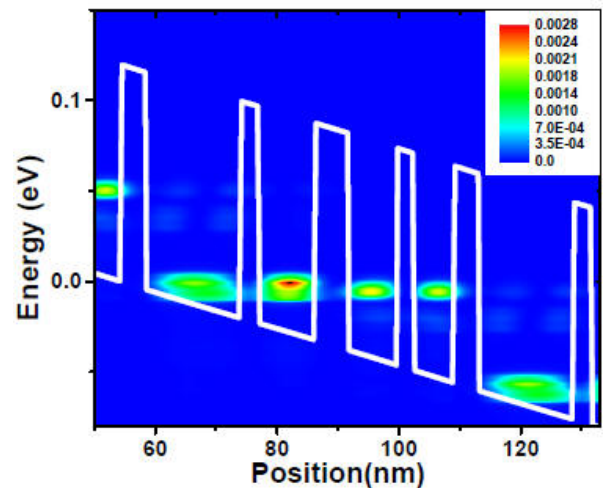


The nextnano.QCL software for Quantum Cascade Lasers

- [Download nextnano.QCL software](#)
- [License activation](#)



This website describes the nextnano.QCL software, a **NEGF quantum transport code** written by Thomas Grange. The nextnano.QCL software has been developed to simulate electron dynamics in heterostructures like superlattices and **quantum cascade lasers** (QCLs). It can also be used to simulate absorption spectra in quantum wells (QWs) and transport in **resonant tunneling diodes** (RTDs).

The software calculates current-voltage characteristics and gain/absorption spectra.

This software is based on a quantum transport method that follows the **nonequilibrium Green's function** (NEGF) framework. The code can be executed using the [nextnanomat](#) software.

Which scattering mechanisms are included?

- Longitudinal polar-optical phonon scattering (polar LO phonon scattering)
- Acoustic phonon scattering
- Charged impurity scattering
- Interface roughness scattering
- Alloy scattering
- Electron-electron scattering

How do I obtain the nextnano.QCL code?

Please [download it from here](#). Additionally, it is strongly recommend to contact support@nextnano.com and inform us that you are interested in this tool. We can then assist you and provide new updates to you.

How do I execute nextnano.QCL?

Open the nextnanomat GUI, open a nextnano.QCL input file and press the Run button.

How do I execute nextnano.QCL from the command line? (not recommended)

```
nextnano.QCL.exe <input file name> <output folder name> <material database name> <License file name>
```

Example:

```
nextnano.QCL.exe "..\nextnano.QCL sample files\MidIR_QCL_YuSlivkenRazeghi_SST2010.xml" "..\Output" "..\Material_Database.xml" "..\License_nnQCL.lic"
```

Are there any tutorial input files available?

- [Tutorial - GaAs/AlGaAs THz QCL](#)
Terahertz quantum cascade lasers operating up to ~ 200 K with optimized oscillator strength and improved injection tunneling
S. Fatholouloumi, E. Dupont, C.W.I. Chan, Z.R. Wasilewski, S.R. Laframboise, D. Ban, A. Mátyás, C. Jirauschek, Q. Hu, H. C. Liu
Optics Express 20, 3866 (2012)
- [Tutorial - InGaAs/InAlAs Mid-IR QCL](#)
Injector doping level-dependent continuous-wave operation of InP-based QCLs at $\lambda = 7.3 \mu\text{m}$ above room temperature
J. S. Yu, S. Slivken, M. Razeghi
Semiconductor Science and Technology 25, 125015 (2010)

Further tutorials can be found here: [Tutorials](#)

Where can I find some background on the implemented physics?

The NEGF method for QCLs is described in the following publications where the nextnano.QCL code was used.

- [Contrasting influence of charged impurities on transport and gain in terahertz quantum cascade lasers](#)
T. Grange
Physical Review B 92, 241306(R) (2015)
- [Nanowire terahertz quantum cascade lasers](#)
T. Grange
Applied Physics Letters 105, 141105 (2014)
- [Electron transport in quantum wire superlattices](#)

T. Grange
Physical Review B 89, 165310 (2014)

A good introduction is also the tutorial talk [Modeling electron transport in quantum cascade lasers](#) given by Thomas Grange at the International Quantum Cascade Laser School and Workshop (Cassis/France, 2018).

Copyright information

The nextnano.QCL software has been developed by Thomas Grange. It is written in C#. For publications of Thomas Grange, see [his profile on Google Scholar](#).



The nextnano.QCL software is distributed by the [nextnano GmbH](#).

For questions or feedback about the software, please contact support@nextnano.com.

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Last update: **2018/11/05 10:10**

