

# Dr. François M.G.J. Coppens

(30 March 1978)

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## Research interests

Superfluid helium, quantum vortices in superfluids, (time-dependent) density functional theory, Monte Carlo methods, atomic- clusters and cluster collisions, high performance computing, data visualisation

## Programming languages, methods, etc.

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|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fortran                         | <ul style="list-style-type: none"><li>• Parallelisation and optimisation of in-house written code to simulate the quantum dynamics of superfluid <math>^4\text{He}</math> using time-dependent He-DFT. Code optimised using Intel's MKL to run on Calmip/EOS, in collaboration with Nicolas Renon and Emmanuel Courcelle from Calmip.</li><li>• Publication on Github for public use, with accompanying material explaining the method and how to use the code, with included example calculations:<ul style="list-style-type: none"><li>- <a href="https://github.com/bcntls2016/4hedft">https://github.com/bcntls2016/4hedft</a></li><li>- <a href="https://github.com/bcntls2016/4hedft-vortex">https://github.com/bcntls2016/4hedft-vortex</a></li><li>- <a href="https://github.com/bcntls2016/4hetddft-isotropic">https://github.com/bcntls2016/4hetddft-isotropic</a></li><li>- <a href="https://github.com/bcntls2016/4hetddft-anisotropic">https://github.com/bcntls2016/4hetddft-anisotropic</a></li></ul></li><li>• Prepared and taught a 2-day workshop on using He-DFT during the CECAM summer school: <a href="https://www.cecarn.org/workshop-1381.html">https://www.cecarn.org/workshop-1381.html</a></li></ul> |
| C/C++                           | <p>Self-written code:</p> <ul style="list-style-type: none"><li>• Ising model (Metropolis and Wolff), study of critical behaviour.</li><li>• Nematic liquid crystals (Metropolis), behaviour of topological defects on constrained geometries in the presence/absence of curvature.</li><li>• Code profiling and optimisation (using GCC/GProf) for local computer cluster at Lorentz Institute for theoretical physics, Leiden, The Netherlands.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Data analysis and visualisation | <ul style="list-style-type: none"><li>• Python, Gnuplot (2D), Matplotlib (2D),</li><li>• Paraview (3D)</li><li>• UNIX/Linux Bash programming to create automated workflows</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

## Education

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| 2018-current                   | <b>Postdoc:</b> Laboratoire de Physique Théorique (UMR 5152), CNRS NEXT/IRT, France                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 2015-2018                      | <p><b>PhD in theoretical physics:</b> Laboratoire Collisions Agrégats Réactivité (UMR 5589), Chaire d'attractivité IMDYNHE 2014 de l'IDEX-UNITI, Université Paul Sabatier, Toulouse, France</p> <p><i>Thesis advisor:</i> dr. N. Halberstadt, prof. dr. M. Barranco</p> <p><i>Thesis title:</i> Ultrafast quantum dynamics of doped super-fluid helium nanodroplets</p> <p><i>Defended on:</i> Friday 15 June 2018.</p> <p><b>Formation:</b> Introduction au Calcul Haute Performance et prise en main du système EOS, Calmip (février 2016)</p> |
| <b>Professional intermezzo</b> | Groupe OPEN Nederland B.V.; Systems administrator (2014-2015)<br>OGD IT services B.V.; Systems administrator (2013-2014)                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 2010-2013                      | <p><b>Master in theoretical physics</b>, Lorentz Institute, Leiden University, the Netherlands</p> <p><i>Thesis advisor:</i> prof. dr. Vincenzo Vitelli</p> <p><i>Thesis title:</i> Monte Carlo simulations of nematic liquid crystals in confined geometries</p>                                                                                                                                                                                                                                                                                |
| 2005-2010                      | <p><b>Bachelor in physics</b>, Leiden University, the Netherlands</p> <p><i>Thesis advisor:</i> prof. dr. Martin van Exter</p> <p><i>Thesis title:</i> Near-field correlations in down-converted light with a strongly focused pump</p>                                                                                                                                                                                                                                                                                                          |
| 2004-2005                      | Propedeuse in applied physics, TH Rijswijk, the Netherlands                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 2003-2004                      | HAVO (track: Natural sciences & Technology), Roosendaal, the Netherlands<br><i>(career reorientation)</i>                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 1997-2000                      | MBO Systems administration, Zoomvliet college, Roosendaal, the Netherlands                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

## Languages

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|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dutch   | Maternal                                                                                                                                                                                                               |
| English | Bilingual (TOEIC score 950 ~ CERF C1)                                                                                                                                                                                  |
| French  | Intermediate: <ul style="list-style-type: none"> <li>• Alliance Française Toulouse, 4 weeks intensive course (70 hours), CEFR A2</li> <li>• Alliance Française Toulouse, Evening course (48 hours), CEFR B1</li> </ul> |
| German  | working knowledge                                                                                                                                                                                                      |

## Scientific publications

- 2011 | **Type-I spontaneous parametric down-conversion with a strongly focused pump.** H. Di Lorenzo Pires, F. Coppens and M. van Exter. *Phys. Rev. A* **83**(3), pp. 033837(8); doi: [10.1103/PhysRevA.83.033837](https://doi.org/10.1103/PhysRevA.83.033837)
- 2017 | **Head-on collisions of Xe atoms against superfluid  $^4\text{He}$  nanodroplets.** François Coppens, Antonio Leal, Manuel Barranco, Nadine Halberstadt and Martí Pi. *J. Low Temp. Phys.* **187**(5), pp. 439-445; doi: [10.1007/s10909-016-1690-x](https://doi.org/10.1007/s10909-016-1690-x)
- 2017 | **Capture of Xe and Ar atoms by quantized vortices in  $^4\text{He}$  nanodroplets.** François Coppens, Francesco Ancilotto, Manuel Barranco, Nadine Halberstadt and Martí Pi. *Phys. Chem. Chem. Phys.* **19**(36), pp. 24805-24818; doi: [10.1039/C7CP03307A](https://doi.org/10.1039/C7CP03307A)
- 2017 | **Imaging Excited-State Dynamics of Doped He Nanodroplets in Real-Time.** Johannes von Vangerow, François Coppens, Antonio Leal, Martí Pi, Manuel Barranco, Nadine Halberstadt, Frank Stienkemeier and Marcel Mudrich. *J. Phys. Chem. Lett.* **8**(1), pp. 307-312; doi: [10.1021/acs.jpclett.6b02598](https://doi.org/10.1021/acs.jpclett.6b02598)
- 2017 | **Density functional theory of doped superfluid liquid helium and nanodroplets.** Francesco Ancilotto, Manuel Barranco, François Coppens, Jussi Eloranta, Nadine Halberstadt, Alberto Hernando, David Mateo and Martí Pi. *Int. Rev. Phys. Chem.* **36**(4), pp. 621-707; doi: [10.1080/0144235X.2017.1351672](https://doi.org/10.1080/0144235X.2017.1351672)
- 2018 | **Desorption dynamics of RbHe exciplexes off He nanodroplets induced by spin-relaxation.** François Coppens, Johannes von Vangerow, Manuel Barranco, Nadine Halberstadt, Frank Stienkemeier, Martí Pi and Marcel Mudrich. *Phys. Chem. Chem. Phys.* **20**(14), pp. 9309-9320; doi: [10.1039/C8CP00482J](https://doi.org/10.1039/C8CP00482J)



## Talks

- 2016 | **Real-time dynamics in  $^4\text{He}$  nanodroplets.** GDR 3575 du CNRS ThémS, December; Lille, France
- 2017 | **Xe capture by quantised vortices.** 7e Journées de Dynamique de Sud-Ouest, June; Montpellier, France
- 2017 | **Dopant Dynamics in Superfluid helium-4 Nanodroplets: from Statics to Time-Dependent He-DFT.** CECAM School (instructor), June; Toulouse, France; url: <https://www.cecarn.org/workshop-1381.html>
- 2017 | **Capture of Xe/Ar by quantised vortices inside He droplets.** International Symposium Atomic Cluster Collisions, October; Varadero, Cuba

## Poster presentations

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| 2016 | <b>Head-on Collisions of Xe Atoms Against Superfluid <math>^4\text{He}</math> Nanodroplets.</b> <i>International Conference on Quantum Fluids and Solids</i> , July; Prague, Czech Republic |
| 2017 | <b>Capture of Xe and Ar atoms by quantised vortices in <math>^4\text{He}</math> droplets.</b> <i>Conference on Quantum Fluid Clusters</i> , June; Obergurgl, Austria                        |
| 2018 | <b>Capture of Xe and Ar atoms by quantised vortices in <math>^4\text{He}</math> droplets.</b> <i>International Symposium on Quantum Fluids and Solids</i> , July; Tokyo, Japan              |

## Experience outside of academia

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| 2014-2015 | <b>Groupe OPEN Nederland (full-time)</b><br>Systems administrator                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 2013-2014 | <b>OGD ICT Services (3 days a week/full-time)</b><br>Customer support and administration of Windows environments                                                                                                                                                                                                                                                                                                                                                                                               |
| 2007-2013 | <b>Various jobs (3 days a week), including</b><br>three years of committee work as secretary, for student association V.S.L. Catena in Leiden. The goal of this committee was to manage its computer network and function as an educational platform for members with an interest in technology and computer science. The network is mixed Windows/Linux environment running on equipment from Cisco, Soekris and VMware.<br><br>OGD ICT Services<br><br>Leiden Institute of Advanced Computer Science (LIACS) |
| 2004-2007 | <b>Networking4All B.V. (3 days a week)</b><br>Datacentre administrator, Consultant/software developer<br><br>(Career reorientation)                                                                                                                                                                                                                                                                                                                                                                            |
| 2001-2003 | <b>Verburgh B.V., Bergen op Zoom (full-time)</b><br>Network Engineer                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 2000-2001 | <b>DataByte, Steenbergen (full-time)</b><br>Systems administrator                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 1998-2000 | <b>Pantra International, Rotterdam (full-time)</b><br>Systems administrator                                                                                                                                                                                                                                                                                                                                                                                                                                    |