

Christophe De Beule

DR. SC. PHYSICS · CONDENSED MATTER THEORY

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● Incoming **Assistant Professor** · NCKU & QFort, Tainan (Taiwan) · Aug 2026

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OVERVIEW

My research interests concern the electronic and structural properties of **two-dimensional materials**, including graphene and other van der Waals materials. I am especially interested in **quantum geometry**, **band topology**, and **correlated electronic phases** of artificial low-dimensional quantum materials. My current focus is on **moiré materials**, which are created by stacking atomically-thin layers with a relative twist angle or lattice mismatch, such as twisted transition-metal dichalcogenide bilayers. In particular, the effect of structural reconstruction and Coulomb interactions on the low-temperature electronic properties.

RESEARCH HIGHLIGHT

Christophe De Beule, R. Smeyers, W. Nieto Luna, E. J. Mele, and L. Covaci. *Elastic screening of pseudogauge fields in graphene*. *Phys. Rev. Lett.* **134**, 046404 (2025). Awarded best poster on fundamentals at Graphene Week 2024 ([interview](#)).

Pseudomagnetic fields in strained graphene are “screened” by optical lattice displacements. Our theory resolves discrepancies between continuum elasticity and molecular dynamics, and shows that elastic screening can drastically change the electronic properties of strain-patterned graphene.

PHYSICAL REVIEW LETTERS

★ BEST POSTER ON FUNDAMENTALS · GRAPHENE WEEK

EDUCATION

- 2012–2017 **PhD, Physics** — **FELICITATIONS OF THE JURY** Condensed Matter Theory group, University of Antwerp, Belgium. Award date: 23 Nov 2017.
- 2010–2012 **MSc, Physics** — **GREATEST DISTINCTION** University of Antwerp, Belgium.
- 2007–2010 **BSc, Physics** — **GREAT DISTINCTION** University of Antwerp, Belgium.

RESEARCH EXPERIENCE

- FROM 08.2026 **Assistant Professor** **INCOMING** National Cheng Kung University & Center for Quantum Frontiers of Research and Technology (QFort), Tainan (Taiwan).
- 05.2025–07.2026 **Postdoctoral Researcher** University of Antwerp, Belgium — COMMIT group.
- 03.2022–04.2025 **Postdoctoral Researcher** University of Pennsylvania, USA — group of Eugene Mele. First year supported by an INTER Mobility grant of the Luxembourg National Research Fund (FNR).
- 10.2020–02.2022 **Postdoctoral Researcher** University of Luxembourg, Luxembourg — group of Thomas Schmidt.
- 04.2018–09.2020 **Postdoctoral Researcher** Technical University of Braunschweig, Germany — group of Patrik Recher.
- 2012–2017 **PhD Student** University of Antwerp, Belgium — CMT group. Supported by a PhD fellowship of Research Foundation Flanders (FWO).

PUBLICATIONS

17

FIRST-AUTHOR
PEER-REVIEWED

4

PHYS. REV. LETTERS
(1 COVER FEATURE)

3

PRB EDITOR'S
SUGGESTIONS

1

PNAS
ARTICLE

1

ACS NANO
ARTICLE

PREPRINTS · UNDER REVIEW

- 32 C. De Beule, Y. Lai, L. Peng, D. Bennett, S. Adam. Lattice Relaxation in Moiré Heterobilayers. *Phys. Rev. B* (under review). arXiv:2605.17805
- 31 C. De Beule, L. Peng, E. J. Mele, S. Adam. Role of electron-electron interactions in M-valley twisted transition metal dichalcogenides. *PNAS* (under review). arXiv:2508.14283
- 30 A. Mreńca-Kolasińska, C. De Beule, J.-T. Shi, A. Garcia-Ruiz, D. Kochan, K. Richter, M.-H. Liu. Pseudomagnetic focusing of valley-polarized beams in strained graphene. *2D Materials* (under review). arXiv:2505.21056
- 29 J. Barrier, L. Peng, C. De Beule, S. Xu, V. I. Fal'ko, K. Watanabe, T. Taniguchi, A. K. Geim, S. Adam, A. I. Berdyugin. Coulomb screening of superconductivity in magic-angle twisted bilayer graphene. *Phys. Rev. X* (under review). arXiv:2412.01577

REFEREED PUBLICATIONS

- 28 P. Reséndiz-Vázquez, C. De Beule, T.-H.-Y. Vu, K. Xing, D. McEwen, D. Bennett, L. Peng, H. González-Herrero, S. Adam, M. T. Edmonds, M. S. Fuhrer. Disorder-induced symmetry breaking in moiré bands of marginally twisted bilayer MoS₂. *ACS Nano* (2026), *accepted, in press*. arXiv:2602.06318
- 27 M.-H. Liu, C. De Beule, A. Mreńca-Kolasińska, H.-Y. Wu, A. Garcia-Ruiz, D. Kochan, K. Richter. Scalable tight-binding model for strained graphene. *Phys. Rev. B* 113, 195429 (2026). **EDITOR'S SUGGESTION**
- 26 C. De Beule, G. N. Pallewela, M. M. Al Ezzi, L. Peng, E. J. Mele, S. Adam. Theory for Lattice Relaxation in Marginally Twisted Bilayers. *Phys. Rev. B Letter* (2026), *accepted, in press*. **EDITOR'S SUGGESTION**
- 25 L. Peng, C. De Beule, Y. Lai, D. Li, L. Yang, E. J. Mele, S. Adam. Itinerant Magnetism in Twisted Bilayer WSe₂ and MoTe₂. *Phys. Rev. B* 113, L161119 (2026).
- 24 C. De Beule, M.-H. Liu, B. Partoens, L. Covaci. Gate-tunable Resonances and 1D Channel in a Graphene Nanoslide. *Phys. Rev. B* 113, L201403 (2026), *Letter*.
- 23 V. T. Phong, K. Kunkelmann, C. De Beule, M. M. Al Ezzi, R.-J. Slager, S. Adam, E. J. Mele. Squeezing Quantum States in Three-Dimensional Twisted Crystals. *Phys. Rev. B* 111, 245156 (2025).
- 22 C. De Beule, R. Smeyers, W. Nieto Luna, E. J. Mele, L. Covaci. Elastic Screening of Pseudogauge Fields in Graphene. *Phys. Rev. Lett.* 134, 046404 (2025).
- 21 M. M. Al Ezzi, G. N. Pallewela, C. De Beule, E. J. Mele, S. Adam. Analytical Model for Atomic Relaxation in Twisted Moiré Materials. *Phys. Rev. Lett.* 133, 266201 (2024).
- 20 C. De Beule, S. Gassner, S. Talkington, E. J. Mele. Floquet–Bloch theory for nonperturbative response to a static drive. *Phys. Rev. B* 109, 235421 (2024).
- 19 C. De Beule, E. J. Mele. Berry Curvature Spectroscopy from Bloch Oscillations. *Phys. Rev. Lett.* 131, 196603 (2023).
- 18 C. De Beule, V. T. Phong, E. J. Mele. Roses in the nonperturbative current response of artificial crystals. *PNAS* 120, e2306384120 (2023).
- 17 P. Wittig, F. Dominguez, C. De Beule, P. Recher. Localized states coupled to a network of chiral modes in minimally twisted bilayer graphene. *Phys. Rev. B* 108, 085431 (2023).
- 16 P. M. Tam*, C. De Beule*, C. L. Kane. Topological Andreev rectification. *Phys. Rev. B* 107, 245422 (2023). **EDITORS' SUGGESTION**
- 15 A. Haller, S. Hedge, C. Xu, C. De Beule, T. L. Schmidt, T. Meng. Black hole mirages: Electron lensing and Berry curvature effects in inhomogeneously tilted Weyl semimetals. *SciPost Phys.* 14, 119 (2023).
- 14 C. De Beule, V. T. Phong, E. J. Mele. Network model for periodically strained graphene. *Phys. Rev. B* 107, 045405 (2023).
- 13 L. Bittermann, C. De Beule, D. Frombach, P. Recher. Probing Majorana bound states via a pn junction containing a quantum dot. *Phys. Rev. B* 106, 075305 (2022).
- 12 C. De Beule, S. Groenendijk, T. Meng, T. L. Schmidt. Artificial event horizons in Weyl semimetal heterostructures and their non-equilibrium signatures. *SciPost Phys.* 11, 095 (2021).
- 11 C. De Beule, F. Dominguez, P. Recher. Network model and four-terminal transport in minimally twisted bilayer graphene. *Phys. Rev. B* 104, 195410 (2021).
- 10 C. De Beule, F. Dominguez, P. Recher. Effective Floquet model for minimally twisted bilayer graphene. *Phys. Rev. B* 103, 195432 (2021).
- 9 C. De Beule, P. G. Silvestrov, M.-H. Liu, P. Recher. Valley splitter and transverse valley focusing in twisted bilayer graphene. *Phys. Rev. Research* 2, 043151 (2020).
- 8 C. De Beule, F. Dominguez, P. Recher. Aharonov–Bohm Oscillations in Minimally Twisted Bilayer Graphene. *Phys. Rev. Lett.* 125, 096402 (2020). **★ COVER FEATURE**
- 7 C. De Beule, R. Saniz, B. Partoens. Crystalline topological states at a topological insulator junction. *J. Phys. Chem. Solids* 128, 144–151 (2018).
- 6 C. De Beule, M. Zarenia, B. Partoens. Transmission in graphene–topological insulator heterostructures. *Phys. Rev. B* 95, 115424 (2017).
- 5 C. De Beule, N. Traverso Ziani, M. Zarenia, B. Partoens, B. Trauzettel. Correlation and current anomalies in helical quantum dots. *Phys. Rev. B* 94, 155111 (2016).
- 4 M. Van der Donck, C. De Beule, B. Partoens, F. M. Peeters, B. Van Duppen. Piezoelectricity in asymmetrically strained bilayer graphene. *2D Mater.* 3, 035015 (2016).
- 3 K. Govaerts, K. Park, C. De Beule, D. Lamoen. Effect of Bi bilayers on the topological states of Bi₂Se₃: A first-principles study. *Phys. Rev. B* 90, 155124 (2014).
- 2 K. Park, C. De Beule, B. Partoens. The ageing effect in topological insulators: evolution of the surface electronic structure of Bi₂Se₃ upon K adsorption. *New J. Phys.* 15, 113031 (2013).
- 1 C. De Beule, B. Partoens. Gapless interface states at the junction between two topological insulators. *Phys. Rev. B* 87, 115113 (2013).

INVITED TALKS

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| 05.26 NTHU · Quantum transport & frustrated magnetism in strained graphene <i>Inv. by Po-Yao Chang</i> | 05.26 IOP, Taiwan · Quantum transport & frustrated magnetism in strained graphene <i>Inv. by Chung-Ting Ke</i> |
| 04.26 UCLouvain · Quantum transport & frustrated magnetism in strained graphene <i>Inv. by J.-C. Charlier</i> | 04.26 Univ. Luxembourg · Quantum transport & frustrated magnetism in strained graphene <i>Inv. by Thomas Schmidt</i> |
| 04.26 TU Braunschweig · Quantum transport & frustrated magnetism in strained graphene <i>Inv. by Patrik Recher</i> | 03.26 WashU · Quantum transport & frustrated magnetism in strained graphene <i>Inv. by Shaffique Adam</i> |
| 03.26 APS GPS · Analytical theory for lattice relaxation in moiré materials | 02.26 Univ. Liège · Quantum transport & frustrated magnetism in strained graphene <i>Inv. by Philippe Ghosez</i> |
| 11.25 NUS · Quantum transport & frustrated magnetism in strained graphene <i>Inv. by Alexey Berdyugin</i> | 11.25 IAMS, Taiwan · Elastic screening of pseudogauge fields in graphene <i>Inv. by Mei-Yin Chou</i> |

11.25 NCKU · Colloquium: The Soft Side of Moiré Materials *Inv. by Luke Smith*

08.25 Univ. Regensburg · Elastic screening of pseudogauge fields in graphene *Inv. by Klaus Richter*

06.25 IOP, Taiwan · Lattice relaxation, soliton networks & domain-wall modes in bilayer moirés *Inv. by Chen-Hsuan Hsu*

04.25 Rutgers · Lattice relaxation, soliton networks & pseudogauge fields in bilayer moirés *Inv. by Eva Y. Andrei*

01.25 NCKU · Lattice relaxation in homobilayer twist moirés *Inv. by Ming-Hao Liu*

08.23 UAntwerp · Topological Andreev rectification *Inv. by Bart Partoens*

05.20 Univ. Luxembourg · Valley chiral networks in minimally twisted bilayer graphene *Inv. by Thomas Schmidt*

08.19 KU Leuven · Valley splitter & transverse valley focusing in twisted bilayer graphene *Inv. by Kristof Moors*

02.18 TU Braunschweig · Topological crystalline states at the interface of two topological insulators *Inv. by Patrik Recher*

09.25 TU Delft · Elastic screening of pseudogauge fields in graphene *Inv. by Anton Akhmerov*

06.25 NTU, Taiwan · Lattice relaxation, soliton networks & domain-wall modes in bilayer moirés *Inv. by Guang-Yu Guo*

04.25 WashU · Lattice relaxation, soliton networks & pseudogauge fields in bilayer moirés *Inv. by Shaffique Adam*

03.25 Flatiron Institute · Lattice relaxation in homobilayer twist moirés *Inv. by Valentin Crépel*

08.24 Drexel · Current state-of-the-art in moiré transition metal dichalcogenides *Inv. by Jörn Venderbos*

08.23 Univ. Luxembourg · Berry curvature spectroscopy from Bloch oscillations *Inv. by Thomas Schmidt*

01.20 NCKU · Electronic transport in twisted bilayer graphene *Inv. by Ming-Hao Liu*

02.18 TU Dresden · Topological crystalline states at the interface of two topological insulators *Inv. by Tobias Meng*

— TEACHING EXPERIENCE

- 2020 · 2024 Introduction to Wolfram Mathematica — lectures & recitation, TU Braunschweig (2020) and UPenn (2024).
2020 Topological Systems & Quantum Computation — recitation, TU Braunschweig (Prof. P. Recher).
2019 Dynamics of Fermi Liquids in 1D — recitation, TU Braunschweig (Prof. P. Recher).
2014–2015 Advanced Quantum Mechanics — recitation & course development, UAntwerp (Prof. B. Partoens).
2014 Analytical Mechanics — recitation & course development, UAntwerp (Prof. B. Partoens).
2013–2014 Computer Lab — tutoring of student MATLAB programming projects, UAntwerp.

— SUPERVISION & MENTORING

- 2025–NOW Che-Pin Hsu — PhD student, Ming-Hao Liu group, NCKU.
2024 Mohammed M. Al Ezzi — PhD student, Shaffique Adam group, NUS.
2024–2025 Robin Smeyers — PhD student, CMT group, UAntwerp.
2023–2025 Steven Gassner — PhD student, UPenn.
2018–2021 Patrick Wittig — PhD student, Recher group, TU Braunschweig.
2018–2020 Lena Bittermann — PhD student, Recher group, TU Braunschweig.
2015 Timo Kerremans — Bachelor student, CMT group, UAntwerp.

— INSTITUTIONAL RESPONSIBILITIES

- 2024–2025 Organization of weekly group meetings & invited talks — UPenn.
2012–2016 Organization of Physics Colloquia — Antwerp Young Minds, UAntwerp.