Blagoje Oblak : Curriculum Vitae

(Last update: March 2024)

Personal information

Born:	1989, September 1, Belgrade (Serbia)
Citizenship:	Belgian, Serbian
Languages:	French and Serbo-Croatian (native), English (fluent), Dutch, German, Russian (basic)
Family:	Married, three children

Current position

Since Feb 2024: **CNRS research fellow** at Université Claude Bernard, Lyon (France).

Past positions and education

Jul 2023–Jan 2024:	FNRS postdoctoral researcher at ULB Brussels (Belgium).
Oct 2020–Jun 2023:	Marie Curie postdoctoral researcher at *Centre de Physique Théorique*, *École Polytechnique*, Palaiseau (France).
Oct 2019–Mar 2022:	Postdoctoral researcher at *Laboratoire de Physique Théorique et Hautes Énergies*, *Sorbonne Université*, Paris (France).
Oct 2016–Sep 2019:	Postdoctoral researcher at *Institut für Theoretische Physik*, *ETH Zürich* (Switzerland).
Oct 2015–Jul 2016:	Visiting PhD student at Trinity College and Department of Applied Mathematics and Theoretical Physics, University of Cambridge (United Kingdom).
Oct 2012–Sep 2016:	PhD student in theoretical physics at ULB Brussels (Belgium). Thesis "BMS Particles in Three Dimensions" supervised by Glenn Barnich, awarded a Springer Theses prize and published as a book by Springer. (Distinctions are not specified for PhD theses at ULB.)
Sep 2007–Jun 2012:	Bachelor and Master in physical sciences at ULB Brussels (Belgium). Awarded with *La plus grande distinction (summa cum laude)*. Master Thesis prize awarded by the Belgian Physical Society, and Solvay Award awarded by the International Solvay Institutes.

Research keywords

From most relevant to least relevant (see publications for details):

1. Geometry and deformations of **quantum Hall droplets**
2. **Berry phases** due to unitary actions of infinite-dimensional groups
3. Nonlinear **edge modes**
4. **Virasoro group** and algebra
5. **Asymptotic symmetries** of gravity, gauge theories and topological field theories
6. Euler-Arnold (Lie-Poisson) equations in **hydrodynamics**
7. Diffeomorphism groups and their central extensions
8. Infinite-dimensional symplectic geometry

Publications *(Authors listed alphabetically in all entries except [1–3, 7, 12, 14].)*

• On quantum Hall physics and hydrodynamics:

[1] B. Oblak, B. Lapierre, P. Moosavi, J.-M. Stéphan and B. Estienne, "Anisotropic Quantum Hall Droplets," *Phys. Rev. X* 14 (2024) 1, 011030, 2301.01726.

[2] B. Oblak and B. Estienne, "Adiabatic Deformations of Quantum Hall Droplets," *SciPost Phys.* 15 (2023) no.4, 159, 2212.12935.

[3] B. Oblak, N. Regnault and B. Estienne, "Equipartition of Entanglement in Quantum Hall States," *Phys. Rev. B* 105 (2022) no.11, 115131, 2112.13854.

[4] B. Estienne, B. Oblak and J.-M. Stéphan, "Ergodic Edge Modes in the 4D Quantum Hall Effect," *SciPost Phys.* 11 (2021), 016, 2104.01860.

[5] B. Oblak, "Topological Bifurcations and Reconstruction of Travelling Waves," *Phys. Fluids* 33 (2021), 027107, 2011.02458.

[6] B. Oblak, "Hirota-Satsuma Dynamics as a Non-Relativistic Limit of KdV Equations," *Phys. Lett. A* 384 (2020) no. 18, 126389, 2002.04835.

[7] B. Oblak and G. Kozyreff, "Berry Phases in the Reconstructed KdV Equation," *Chaos* 30 (2020), 113114, 2002.01780. (Selected as a 'featured' paper.)

[8] B. Oblak, "Orbital Bifurcations and Shoaling of Cnoidal Waves," *J. Math. Fluid Mech.* 22 (2020) 2, 1907.01438.

• On asymptotic symmetries and gravitation:

[9] J. Bosma, M. Geiller, S. Majumdar and B. Oblak, "Radiative Asymptotic Symmetries of 3D Einstein-Maxwell Theory," to appear in *SciPost Phys.* (2024), 2311.09156.

[10] B. Oblak and A. Seraj, "Orientation Memory of Magnetic Dipoles," *Phys. Rev. D* 109 (2024) 4, 044037, 2304.12348.

[11] X. Bekaert and B. Oblak, "Massless scalars and higher-spin BMS in any dimension," *JHEP* 11 (2022), 022, 2209.02253.

[12] A. Seraj and B. Oblak, "The Precession Caused by Gravitational Waves," *Phys. Rev. Lett.* 129 (2022) no.6, 061101, 2203.16216.

[13] H. Afshar and B. Oblak, "Flat JT gravity and the BMS-Schwarzian," *JHEP* 11 (2022), 172, 2112.14609.

[14] A. Seraj and B. Oblak, "Gyroscopic Gravitational Memory," *JHEP* 11 (2023), 057, 2112.04535.

[15] R. Javadinezhad, B. Oblak and M. M. Sheikh-Jabbari, "Near-Horizon Extremal Geometries: Coadjoint Orbits and Quantization," *JHEP* 1804 (2018) 025, 1712.07627.

[16] B. Oblak, "Thomas Precession for Dressed Particles," *Class. Quant. Grav.* 35 (2018), no.5, 054001, 1711.05753. (Accompanied by the *CQG+* blog post https://cqgplus.com/2018/02/15/can-you-see-asymptotic-symmetries.)

[17] B. Oblak, "Probing Wigner Rotations for Any Group," *J. Geom. Phys.* 129 (2018) 168, 1710.06883.

[18] B. Oblak, "Berry Phases on Virasoro Orbits," *JHEP* 10 (2017) 114, 1703.06142.

[19] B. Oblak, "BMS Particles in Three Dimensions," Ph.D. thesis (ULB, 2016), 1610.08526. Published in *Springer Theses* (2017), ISBN 978-3-319-61878-4.

[20] A. Campoleoni, H. A. González, B. Oblak, and M. Riegler, "BMS Modules in Three Dimensions," *Int. J. Mod. Phys.* A31 (2016), no. 12, 1650068, 1603.03812.

[21] H. Afshar, S. Detournay, D. Grumiller, and B. Oblak, "Near-Horizon Geometry and Warped Conformal Symmetry," *JHEP* 03 (2016) 187, 1512.08233.

[22] A. Campoleoni, H. A. González, B. Oblak, and M. Riegler, "Rotating Higher Spin Partition Functions and Extended BMS Symmetries," *JHEP* 04 (2016) 034, 1512.03353.

[23] B. Oblak, "From the Lorentz Group to the Celestial Sphere," 1508.00920. Published in the proceedings of the seventh *Brussels Summer School in Mathematics*.

[24] G. Barnich, H. A. González, A. Maloney, and B. Oblak, "One loop partition function of three-dimensional flat gravity," *JHEP* 2015 (2015), no. 4, 1502.06185.

[25] B. Oblak, "Characters of the BMS Group in Three Dimensions," *Commun. Math. Phys.* 340 (2015), no. 1, 413–432, 1502.03108.

[26] G. Barnich and B. Oblak, "Notes on the BMS group in three dimensions: II. Coadjoint representation," *JHEP* 2015 (2015), no. 3, 1502.00010.

[27] G. Barnich and B. Oblak, "Notes on the BMS group in three dimensions: I. Induced representations," *JHEP* 2014 (2014), no. 6, 1403.5803.

[28] G. Barnich and B. Oblak, "Holographic positive energy theorems in three-dimensional gravity," *Class. Quant. Grav.* 31 (2014), no. 15, 152001, 1403.3835.

Grants and awards

Physics and mathematics:

- 2021: FNRS postdoctoral grant at ULB for the project "Infinite-Dimensional Geometry of Nonlinear Waves and Topological Edge Modes."
- 2019: Marie Curie grant at *École Polytechnique*, Palaiseau for the project "Asymptotic Symmetries: from Concepts to Observations." [Start date set to October 2020 for convenience].
- 2019: James Arthur fellowship at the Physics Department of New York University, and CoFund Marie Curie grant at ULB for project "Berry Phases and Infinite Symmetries in Topological Systems." [Both declined in order to work on condensed matter physics in France].
- 2017: Springer Theses Prize for PhD thesis, published as a book (ISBN 978-3-319-61878-4).
- 2015: Doctoral fellowship of the Wiener-Anspach Foundation covering university and college fees (Trinity College) at the University of Cambridge for the academic year 2015–2016.
- 2014 and 2015: O.J.O. funding of the Flemish government awarded to the organizing committee of the 10^{th} and 11^{th} Modave Summer Schools. (I was the main organizer of the 11^{th} edition.)
- 2012–2016: FNRS Research Fellowship (most prestigious PhD funding in Belgium).
- 2013: Solvay Award for Master Thesis, and Master Thesis prize of the Belgian Physical Society.
- 2007: Participant at the International Physics Olympiad in Ispahan (Iran); first prize of the Belgian Physics Olympiad (French-speaking category).

Other interests:

- 2003–present: Amateur classical pianist. (2015: Medal of *Commune d'Uccle* for outstanding piano performance. 2008: Presentation of a personal composition at a public piano examination. 2007 and 2008: Johann Sebastian Bach prize of the *Académie de Musique d'Uccle* for best performance of a composition by J.-S. Bach at a public examination.)
- 2002–2019: Participant and five times prize-winner (2002, 2003, 2005, 2006, 2019) of the French spelling contest *Les Championnats d'Orthographe* (previously *Orthographia*, Brussels, Belgium).

Organizational skills

- 2022, Sorbonne Université: Together with B. Estienne, organizer of the workshop "Topological Quantum Phases of Matter Beyond Two Dimensions" held in Jussieu on 20–21 October. I took part in all stages of the organization: setting up the list of speakers, inviting them, booking the conference hall, organizing speaker housing, sending announcements, setting up the website and the registration form, booking the catering. See the website https://www.lpthe.jussieu.fr/topophase/index.html, whose html code and CSS files I wrote by myself.
- 2021 and 2022, Sorbonne Université: Co-creator and co-organizer of the new seminar series "Theory of Quantum Matter" together with C. Brun, M. Casula, N. Cherroret and J.-N. Fuchs. (See website https://quantummattertheory.fr. The goal is to set up regular meetings on condensed matter for the various interested members of *Sorbonne Université*.)
- 2017–2019, ETH Zurich: Organizer of seminars in the group of string theory and quantum field theory. (Scheduling, invitation of speakers, organization of their housing and hosting.)
- 2013 and 2014, ULB: Co-organizer and organizer of the Modave Summer School in mathematical physics. (The school is organized by, and intended for, PhD students. The website of its last edition is https://pmif.ulb.be/XVIIIModave/Homepage.html.)

Teaching and supervision experience

- Since 2022: Supervision of Mathieu Beauvillain, first for his Master theses on the quantum Hall effect (*ENS Paris*, 2022–2023), then for his PhD thesis (*École Polytechnique*, Palaiseau since 2023, co-supervized by Marios Petropoulos).
- 2017, 2018 and 2019, ETH Zurich: Supervision of Bachelor and Master students for student seminars in string theory, conformal field theory, renormalization, and group theory.
- Autumn 2018, ETH Zurich: Head teaching assistant (*Oberassistent*) for the course of quantum mechanics taught by Matthias Gaberdiel in the third year of Bachelor in physics. Organization, conception and correction of exercise sessions and examination sheets.
- September 2015: Lectures on partition functions in three-dimensional gravity at the eleventh Modave Summer School in mathematical physics (Belgium).
- Spring 2014 and 2015, ULB: Teaching assistant for the quantum field theory course taught by Glenn Barnich in the first year of Master in physics. Organization, conception, supervision and correction of exercise sheets and examination sheets. Outstanding student satisfaction reports.
- September 2009 - June 2012, ULB: Student Teaching Assistant. Part of a team of senior students providing assistance in physics for Bachelor students in science, engineering and business.

Services and commissions of trust

Referee for *Journal of High-Energy Physics* since 2015; for *Classical and Quantum Gravity*, *Physics Letters B* and *General Relativity and Gravitation* since 2018; for *Annals of Physics*, *Nuclear Physics B*, *Journal of Mathematical Physics* and *Entropy* since 2019; for *SciPost*, *Symmetry* and *Journal of Applied Physics* since 2020; for *Communications in Mathematical Physics* since 2022.

Presentations at conferences

- January 2024, *Fifth Higher-Spin Workshop* in Mons, Belgium: $W_{1+\infty}$ *symmetry in the Quantum Hall Effect: A Review* (invited talk).
- October 2023, *Carroll Workshop* in Thessaloniki, Greece: *Gyroscopic Memory Effects in Gravity and Electrodynamics* (invited talk).
- July 2023, international workshop on *Quantum Hall edge: New results and old questions* in Villard de Lans, France: *Anisotropic Quantum Hall Droplets* (contributed talk).
- May 2023, French Strings Meeting in Annecy, France: *Gyroscopic Memory Effects in Gravity and Electrodynamics* (invited talk).
- May 2023, international workshop on *Geometric and analytic aspects of the Quantum Hall effect* at SRS research station, Les Diablerets, Switzerland: *Adiabatic Deformations of Quantum Hall Droplets* (invited talk).
- June–July 2022, international workshop on *Out-of-equilibrium and collective dynamics of quantum many-body systems* at ETH Zurich, Switzerland: *Hydrodynamical Drift as a Berry Phase* (contributed talk).
- March 2022, international workshop on *Aspects of Gravity, Mathematics and Physics* at École Polytechnique, France: *Gyroscopic Gravitational Memory* (invited talk).
- December 2021, French conference *Théorie, Univers et Gravitation* at *Institut Henri Poincaré*, Paris, France: *Gyroscopic Gravitational Memory* (contributed talk).
- July 2021, international conference on *Mathematical aspects of quantum phases of matter* in Będlewo, Poland: *Deformational Berry Phases of Quantum Hall Droplets* (invited talk).
- June 2021, French *Kick-off meeting of IRN:QFS*, France (online): *Berry Phases and Drift in the KdV Equation* (contributed talk).
- March 2019, international SwissMAP conference on *Chaos, Holography and Coadjoint Orbits* in Geneva, Switzerland: *Berry Phases in the KdV Equation* (invited talk).
- July 2017, international conference on *String Theory and Quantum Gravity* in Ascona (Switzerland): *Berry Phases of Boundary Gravitons* (contributed talk).
- May 2017, international workshop on *Recent Trends in String Theory and Related Topics* in Tehran (Iran): *Berry Phases of Boundary Gravitons* (invited talk).
- September 2015, lectures at the eleventh international Modave Summer School in mathematical physics (Belgium): *Partition Functions in 3D Quantum Gravity* (I was the organizer of the school).
- August 2014, Brussels Summer School of Mathematics (Belgium): *Physique et géométrie: du groupe de Lorentz à la sphère céleste* (invited talk).
- September 2013, Belgian conference *Actions de Recherches Concertées*, Brussels (Belgium): *Towards induced representations of the BMS_3 group* (invited talk).

Local seminars and lectures

In my talks, substantial effort is invested to engage the audience and present results **pedagogically**. This involves hours of work on LaTeX's beamer environment to prepare the most impactful transitions between slides and design short animated episodes that illustrate geometric concepts. As a result, each presentation is typically displayed at several different institutions:

- **Edge Deformations and anisotropic Quantum Hall Droplets**: Presented at École Normale Supérieure and Université de Lyon 1, Lyon (France, February and May 2023); Université Grenoble Alpes (France, February 2023); Université de Strasbourg (France, March 2023); University of Pisa (Italy, May 2023); Université Libre de Bruxelles (Belgium, November 2023); LPTHE Jussieu, Paris (France, February 2024).

- **Flat JT gravity and the Schwarzian of BMS_2** (video recording at https://www.youtube.com/watch?v=OW4ZN5znGUs): Presented at the Central European Institute for Cosmology and Fundamental Physics, Prague (Czech Republic, November 2022); Technical University Vienna (Austria, November 2022); University of British Columbia (Canada, online, April 2022).

- **Gyroscopic Gravitational Memory** (see https://www.youtube.com/watch?v=kWwauiV6kS0): Presented at *Rencontres Théoriciennes*, Institut Henri Poincaré (France, February 2022).

- **Deformational Berry Phases of Quantum Hall Droplets** (see https://www.youtube.com/watch?v=C0OEfDEfyDU): Presented at Université Grenoble Alpes (France, online, December 2021); École Normale Supérieure, Lyon (France, online, December 2021); Université de Lorraine, Nancy (France, November 2021); and Jagiellonian University (Poland, online, November 2021).

- **An Ultrarelativistic Review of Baby BMS** (video recording at https://www.youtube.com/watch?v=fCDfyu26pik): Lectures delivered at IPhT Saclay as part of the series on 'Celestial Holography' following an invitation by Monica Guica (France, November 2021).

- **Berry Phases in the KdV Equation** or **Stokes Drift as a Berry Phase** (video recording at https://www.youtube.com/watch?v=uoicPVuzhoY): Presented at Université de Tours (France, October 2021); Université Paris-Saclay (France, online, March 2021); École Normale Supérieure, Lyon (France, online, March 2021); Université de Lorraine, Nancy (France, online, February 2021); Université Paul Sabatier, Toulouse (France, online, February 2021); Université Grenoble Alpes (France, online, February 2021); Belgian Quantum Physics Initiative, Brussels (Belgium, February 2020); Nordita, Stockholm (Sweden, April 2019); University of Amsterdam (The Netherlands, December 2018); LPTHE Jussieu, Paris (France, December 2018).

- **Berry Phases of Boundary Gravitons** (short video recording at https://www.youtube.com/watch?v=HjS1JgQD_ac): Presented at the Colloquium of the Black Hole Initiative, Harvard University (USA, April 2018); New York University (USA, April 2018); Columbia University, New York (USA, April 2018); Bogazici University, Istanbul (Turkey, February 2018); CEA Saclay (France, February 2018); École Normale Supérieure, Paris (France, February 2018).

- **BMS Particles and Symmetries in Three Dimensions** (video recording https://pirsa.org/index.php?p=speaker&name=Blagoje_Oblak): Presented at the University of Helsinki (Finland, March 2017); Lie group seminar, University of Erlangen-Nürnberg (Germany, January 2017); ETH Zurich (Switzerland, December 2016); Columbia University, New York (USA, April 2016); Perimeter Institute, Waterloo (Canada, December 2015); DAMTP, University of Cambridge (UK, December 2015); Technical University Vienna (Austria, May 2015); ETH Zurich (Switzerland, March 2015); graduate student seminar, Harvard University (USA, April 2013); University of Belgrade (Serbia, July 2012).