

Curriculum Vitae

Dr. David Dulin

Assistant Professor
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Faculty of Sciences/Division of Physics and Astronomy
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1081 HV, Amsterdam, The Netherlands
Webpage : <https://daviddulinlab.com>
Date of birth : 25th of February 1982; Citizenship : French

Five most important academic achievements

- Established independently the first single-molecule biophysics lab at FAU Erlangen-Nuremberg to study protein-nucleic acids interactions, including fully operational molecular biology and microscopy labs
- Pioneered high-throughput and high-resolution magnetic tweezers set-ups for single-molecule biophysics investigations
- Pioneered the study of SARS-CoV-2 replication-transcription complex at the single-molecule level, leading to the discovery of a mechanism of action of Remdesivir (first FDA approved antiviral drug against COVID19)
- Established new protocols to fabricate custom-designed high quality nucleic acids construct for single-molecule biophysics assays
- Developed novel bespoke force and fluorescence spectroscopy microscopes, such as ultra-stable magnetic tweezers and high-throughput TIRF set-ups for single-molecule experiments

Education

2006-2010 **PhD in Physics** *Paris-Sud XI University, Laboratory Charles Fabry of the Institut d'Optique, France*
Specialization in experimental biophysics. Thesis : "*Observation of the translational activity of single ribosomes with fluorescence microscopy coupled to a microfluidic chip*". Advisor : Prof. Nathalie Westbrook

2000-2006 **Bachelor and Master** Major : physics ; Minor : mathematics , *University of Bordeaux, France*

Employment

Since 01/2021 **Assistant Professor** Physics Department at *Vrije Universiteit Amsterdam, The Netherlands.*

09/2016-08/2022 **Junior Research Group Leader non-tenure track** "Physics and Medicine" *IZKF-FAU Erlangen-Nuremberg, Germany*

08/2014-06/2016 **Post-doc** in the lab of Achillefs Kapanidis, *Department of Physics, University of Oxford, UK*

11/2009-08/2014 **Post-doc** in the lab of Nynke Dekker, *Department of Bionanosciences, TU Delft, The Netherlands*

2006-2009 **Research Assistant** in the lab of Nathalie Westbrook, *Laboratory Charles Fabry of the Institut d'Optique*

Languages

French (Native), English (Fluent, C1), German (Basics, B1.1), Dutch (Basics, A1)

Teaching activities

Since 2021 Advanced Biophysics, *combined M.Sc. at VU Amsterdam, lecture.*

2018-2020 Magnetic tweezers, *B.Sc. Integrated Life Science, FAU Erlangen-Nuremberg, lecture and practicum.*

2010 Micro and Nanofabrication for biophysics, *Nanosciences M.Sc., TU Delft, lecture.*

Teaching assistant for undergraduate laboratory practical course

2008-2009 Ray optics, microscopy, wave optics *Institut d'Optique Graduate School*

Publications

Publications, *preprint*

- R. Chinthapatla, M. Sotoudegan, T. Anderson, I.M. Moustafa, K.T. Passow, S.A. Kennelly, R. Moorthy, D. Dulin, J.Y. Feng, D.A. Harki, R. Kirchdoerfer, C.E. Cameron, J.J. Arnold
Interfering with nucleotide excision by the coronavirus 3'-to-5' exoribonuclease
BioRxiv <https://doi.org/10.1101/2022.08.11.503614>, (2022).
- D. Dulin, Z. Yu, T.J. Cui, B.A. Berghuis, M. Depken and N.H. Dekker
Real-time observation of replicative helicase assembly onto single-stranded DNA
BioRxiv <https://doi.org/10.1101/077800>, (2016).

Publications, *book chapter*

- E. Ostrofet, F.S. Papini, A.M. Malinen and D. Dulin
A single-molecule view on cellular and viral RNA synthesis
In : Joo C., Rueda D. (eds) *Biophysics of RNA-Protein Interactions*. Biological and Medical Physics, Biomedical Engineering. Springer, New York, NY, (2019).
<https://doi.org/10.1007/978-1-4939-9726-8>, (2019).

Publications, *in peer-reviewed journals*

28. S.C. Bera, P.P.B. America, S. Maatsola, M. Seifert, E. Ostrofet, J. Cnossen, M. Spermann, F.S. Papini, M. Depken, A.M. Malinen and D. Dulin
Quantitative parameters of bacterial RNA polymerase open-complex formation, stabilization and disruption on a consensus promoter
Nucleic Acids Research, gkac560 (2022).
27. A.M. Malinen, J. Bakermans, E. Aalto-Setälä, M. Blessing, D.L.V. Bauer, O. Parilova, G.A. Belogurov, D. Dulin, and A.N. Kapanidis
Real-Time Single-Molecule Studies of RNA Polymerase-Promoter Open Complex Formation Reveal Substantial Heterogeneity Along the Promoter-Opening Pathway
Journal of Molecular Biology, 434, 2, p.167383 (2021).
26. M. Seifert, S.C. Bera, P. van Nies, R.N. Kirchdoerfer, A. Shannon, T.T.N. Le, X. Meng, H. Xia, J. M. Wood, L. D. Harris, F.S. Papini, J.J. Arnold, S.C. Almo, T.L. Grove, P.-Y. Shi, Y. Xiang, B. Canard, M. Depken, C.E. Cameron, and D. Dulin
Inhibition of SARS-CoV-2 polymerase by nucleotide analogs : a single molecule perspective
eLife, 10 :e70968 (2021)
25. S.C. Bera, M. Seifert, R.N. Kirchdoerfer, P. van Nies, Y. Wubulikasimu, S. Quack, F.S. Papini, J.J. Arnold, B. Canard, C.E. Cameron, M. Depken and D. Dulin
The nucleotide addition cycle of the SARS-CoV-2 polymerase
Cell Reports, 36 (10), 109650 (2021)
24. E. Ostrofet, F. S. Papini, D. Dulin
Microscopy-spectroscopy SI : High spatiotemporal resolution data from a custom magnetic tweezers instrument
Data in Brief, 105397, (2020).
23. M. Seifert, P. van Nies, F.S. Papini, J.J. Arnold, M.M. Poranen, C.E. Cameron, M. Depken and D. Dulin
Temperature controlled high-throughput magnetic tweezers show striking difference in activation energies of replicating viral RNA-dependent RNA polymerases.
Nucleic Acids Research, 48 (10), 5591-5602 (2020)
22. F. S. Papini, M. Seifert and D. Dulin
High-yield fabrication of nucleic acid constructs for single-molecule force and torque spectroscopy experiments.
Nucleic Acids Research, gkz851, (2019).
21. E. Ostrofet, F. S. Papini, D. Dulin
Correction-free force calibration for magnetic tweezers
Scientific Reports, 8,15920, (2018).
20. D. Dulin*, D.L.V. Bauer, A.M. Malinen, J.J.W. Bakermans, M. Kaller, Z. Morichaud, I. Petushkov, M. Depken, K. Brodolin, A. Kulbachinskiy and A.N. Kapanidis*
Pausing controls branching between productive and non-productive pathways during initial transcription in bacteria
Nature Communications, 9 (1), 1478 (2018). (* : corresponding authors).

19. D. Dulin, J.J. Arnold, T. van Laar, H.-S. Oh, C. Lee, D.A. Harki, M. Depken, C.E. Cameron, and N.H. Dekker
Signatures of Nucleotide Analogue Incorporation by an RNA-Dependent RNA Polymerase Revealed Using High-Throughput Magnetic Tweezers
Cell Reports, 21 (4), 1063, (2017).
18. O. Bugaud, N. Barbier, H. Chommy, N. Fiszman, A. Le Gall, D. Dulin, M. Saguy, N. Westbrook, K. Perronet and O. Namy
Kinetics of CrPV and HCV IRES-mediated eukaryotic translation using single-molecule fluorescence microscopy
RNA, 23, 1626, (2017).
17. F. Kriegel, N. Ermann, R. Forbes, D. Dulin, N. H. Dekker and J. Lipfert
Probing the salt dependence of the torsional stiffness of DNA by multiplexed magnetic torque tweezers
Nucl. Acids Res., 45 (10), 5920, (2017).
16. N. N. Vtyurina, D. Dulin, M. Docter, A. Meyer, N.H. Dekker and E. A. Abbondanzieri
Hysteresis in DNA compaction by Dps is described by an Ising model
Proc. Natl. Acad. Sci. U.S.A., 113, 4982, (2016).
15. D. Dulin^{*}, T.J. Cui, J. P. Cnossen, M. W. Docter, J. Lipfert and N.H. Dekker^{*}
High Spatiotemporal Resolution Magnetic Tweezers : Calibration and Applications to DNA Dynamics
Biophys. J., 109, 2113, (2015). (*** : corresponding author**)
14. D. Dulin, I. D. Vilfan, B. A. Berghuis, M. Poranen, M. Depken and N.H. Dekker
Backtracking behavior in viral RNA-dependent RNA polymerase provides the basis for a second initiation site
Nucl. Acids Res., 43 (21), 10421, (2015).
13. D. Dulin, B. A. Berghuis, M. Depken and N.H. Dekker
Untangling reaction pathways through modern approaches to high-throughput single-molecule force-spectroscopy experiments
Curr. Op. Struct. Biol., 34, 116, (2015).
12. B.A. Berghuis, D. Dulin, Z.-Q. Xu, T. van Laar, B. Cross, R. Janissen, S. Jergic, N. Dixon, M. Depken and N.H. Dekker
Strand separation suffices to establish a long-lived, foolproof DNA-protein lock at the Tus-Ter replication fork barrier
Nature Chem. Biol., 11, 579, (2015).
11. M.M. van Oene, L.E. Dickinson, F. Pedaci, M. Kober, D. Dulin, J. Lipfert, and N.H. Dekker
Biological magnetometry : Torque on superparamagnetic beads in magnetic fields
Phys. Rev. Lett., 114, 218301, (2015).
10. D. Dulin, I.D. Vilfan, B.A. Berghuis, S. Hage, D. Bamford, M. Poranen, M. Depken, and N.H. Dekker
Elongation-competent pauses govern the fidelity of a viral RNA-dependent RNA polymerase
Cell Reports, 10, 983, (2015).
9. Z. Yu, D. Dulin, J. P. Cnossen, M. Koeber, M. van Oene, O. Ordu, B. A. Berghuis, T. Hensgens, J. Lipfert and N.H. Dekker
A force calibration standard for magnetic tweezers
Rev. Sci. Inst., 85, 123114, (2014).
8. J. P. Cnossen, D. Dulin and N.H. Dekker
An optimized software framework for real-time, high-throughput tracking of spherical beads
Rev. Sci. Inst., 85, 103712, (2014).
7. J. Lipfert, G. M. Skinner, J. M. Keegstra, T. Hensgens, T. Jager, D. Dulin, M. Koeber, Z. Yu, S. P. Donkers, F.-C. Chou, R. Das, and N. H. Dekker
Double-Stranded RNA under Force and Torque : Similarities to and Striking Differences from Double- Stranded DNA
Proc. Natl. Acad. Sci. U.S.A., 111, 15408, (2014).
6. D. Dulin, S. Barland, X. Hachair and F. Pedaci
Efficient illumination for microsecond tracking microscopy
PLoS One, 9, e107335, (2014).

5. R. Janissen, B.A. Berghuis, D. Dulin, M. Wink, T. van Laar and N.H. Dekker
Invincible DNA tethers : covalent DNA anchoring for enhanced temporal and force stability in magnetic tweezers experiments
Nucl. Acids Res., 42, e137, (2014).
4. D. Dulin, J. Lipfert, C. M. Moolman, and N. H. Dekker
Studying genomic processes at the single-molecule level : introducing the tools and applications
Nature Rev. Gen., 14, 9, (2013).
3. A. Le Gall*, D. Dulin*, G. Clavier, R. Meallet-Renault, P. Bouyer, K. Perronet, and N. Westbrook
Improved Photon Yield from a Green Dye with a Reducing and Oxidizing System
Chem. Phys. Chem., 12 (9), 1657, (2011) (* : equal contribution).
2. A. Le Gall, K. Perronet, D. Dulin, A. Villing, P. Bouyer, K. Visscher and N. Westbrook
Simultaneous calibration of optical tweezers spring constant and position detector response
Opt. Exp., 18 (25), 26469, (2010).

Peer-reviewed proceedings

1. D. Dulin, A. Le Gall, K. Perronet, N. Soler, D. Fourmy, S. Yoshizawa, P. Bouyer and N. Westbrook
Reduced photobleaching of BODIPY-FL
Proceedings of HBSM 2009, Physics Procedia, 3 (4), 1563, (2010).

Citations statistics

All citations : 1216 ; h-index : 20

Source : Google Scholar

Award

Erasmus exchange fellowship, 2003-2004, *University of Bristol, UK*

ATIP-Avenir CNRS-INSERM, 2020, Competitive funding program from CNRS-INSERM to establish an independant lab in France. Short-listed for the interview ; *declined*.

Funding

Start-up package

2021 **VU Amsterdam - Assistant Professor position**, 5 years position financed by the **BaSyC** consortium grant, including salary and €400k funding (personnel and material).

2016 **FAU Hospital Erlangen-Nuremberg IZKF Junior Group Leader non-tenure track position** 6 years funded position, including €200k equipment, €300k consumables and €1,076 k personnel.

Third-party funding (Total : €1,933.5k+US\$2,490k)

2022 **Dutch Research Council (NWO)** Open Competition Domain Science - M, 4 years funding
Revealing how MDA5 interrogates RNA to signal viral infection and trigger innate immunity.

Role : Lead PI.

€359k, including 1 PhD, equipment and consumables. To be started.

2022 **Dutch Research Council (NWO)** Open Competition Domain Science - XL, 5 years funding
Know your enemy : deciphering coronavirus biochemical cycles from RNA synthesis to assembly.

Consortium of 8 PIs, with a total funding of €3,032k. Role : Lead PI.

€800k for Dulin, including 1 PhD, 1 Postdoc and 1 technician positions and equipment. To be started.

2022 **National Institute of Health (NIH), NIAID** Antiviral Drug Discovery (AViDD), 5 years funding
Rapidly Emerging Antiviral Drug Development Initiative - AViDD Center. Role : co-applicant.

US\$945k, including two positions and consumables. Started in May 2022.

- 2022 **National Institute of Health (NIH), NIAID** Antiviral Drug Discovery (AViDD), 5 years funding
Development of Outpatient Antiviral Cocktails against SARS-CoV-2 and other Potential Pandemic RNA Viruses. Role : co-applicant.
US\$945k, including two positions and consumables. Started in May 2022.
- 2021 **National Institute of Health (NIH), NIAID** R01, 5 years funding
Coronavirus replication. Role : co-applicant.
US\$600k, including 5 years postdoc salary and consumables. Started in March 2021.
- 2020 **Deutsche Forschungsgemeinschaft (DFG)** Individual Research Grant, 2.5 years funding
Revealing the mechanism of directional transcription termination at the single molecule level for the human mitochondrial transcription complex. Role : lead PI.
€276.6k, including 2.5 years postdoc salary and consumables. Started in March 2020.
- 2020 **Deutsche Forschungsgemeinschaft (DFG)** Individual Research Grant, 2.5 years funding
Determinants and dynamics of RNA polymerase I transcription initiation. Role : lead PI.
€276.3k, including 2.5 years postdoc salary and consumables. Started in April 2021.
- 2020 **Deutsche Forschungsgemeinschaft (DFG)** Individual Research Grant, 2 years funding
Revealing the mechanism of nucleotide selection, addition and proofreading of the SARS-coronavirus-1 replication transcription complex at the single molecule level. Role : lead PI.
€221.6k, including 2 years postdoc salary and consumables. Started in August 2021.

Talks at conferences

* indicates since Principal Investigator

- 22*. GRC Enzymes, Co-Enzymes and Metabolism (Invited Speaker), *Waterville Valley, USA* (2022)
- 21*. International Conference on Antiviral Research (ICAR) (Invited Speaker), *Seattle, USA* (2022)
- 20*. Single-Molecule Biophysics Les Houches *Les Houches, France* (2022)
- 19*. Dutch Annual Virology Symposium (Invited Speaker), *Amsterdam, The Netherlands* (2021)
- 18*. CSHL COVID/SARS-CoV-2 Rapid Research Report (Invited Speaker), *Cold Spring Harbour, USA* (2020)
- 17*. Journées Francophone de la Virologie (Invited Speaker), *Lyon, France* (2019)
- 16*. Structure and Dynamics of Biomolecules (Invited Speaker), *Huenfeld, Germany* (2019)
- 15*. Single Molecule Biophysics, *Aspen, USA* (2019)
- 14*. GFV2018 Annual Meeting of the Society for Virology, *Wuerzburg, Germany* (2018)
- 13*. SFB960 Symposium The Biology of RNA-Protein Complexes, *Regensburg, Germany* (2017)
- 12*. FASEB Mechanism and Regulation of Prokaryotic Transcription, *Saxons Rivers, USA* (2017)
11. Gordon Research Conference Viruses and Cells, *Girona, Spain* (2015)
10. Society for General Microbiology Annual Conference, *Birmingham, UK* (2015)
9. Biophysical Society Meeting, *San Francisco, USA* (2014)
8. Chemistry in Relation to Biology and Medical Research, *Veldhoven, The Netherlands* (2013)
7. Biophysical Society Meeting, *Philadelphia, USA* (2013)
6. Annual Dutch meeting on Molecular and Cellular Biophysics, *Veldhoven, The Netherlands* (2012)
5. Congress of the French Physical Society, *Bordeaux, France* (2011)
4. Harden Conference RNAP, *Cambridge, England* (2010)
3. Zurich/Paris young scientist meeting, *Paris, France* (2010)
2. Photonics For Life meeting, *Brussels, Belgium* (2008)
1. Congress of the French Physical Society, *Grenoble, France* (2007)

Posters at conferences

9. Biophysical Society Meeting, *San Diego (USA)* (2020)
8. Single Molecule Biophysics Alpine, *Les Houches (France)* (2020)
7. GRC single molecule, *Mount Snow Resort West Dover, VT (USA)* (2018)
6. GRC single molecule, *Lucca (Barga), Italy* (2014)
5. Harden conference : Machines on genes II, *Oxford (England)* (2012)
4. GRC single molecule, *Mount Snow Resort West Dover, VT (USA)* (2012)
3. Biophysical Society Meeting, *San Diego (USA)* (2012)
2. Annual Dutch meeting on Molecular and Cellular Biophysics, *Veldhoven, The Netherlands* (2010)
1. Biophysical Society Meeting, *Boston (USA)* (2009)

Invited Seminars

* indicates since Principal Investigator

- 37*. Department of Microbiology and Immunology, *Chapel Hill (USA)* (2022)
- 36*. MPI Physics of Light, *Erlangen (Germany)* (2022)
- 35*. Laboratoire d'Ondes et Matière d'Aquitaine, *Bordeaux (France)* (2022)
- 34*. Chair of Biophysics, Utrecht University Physics Department, *Utrecht (The Netherlands)* (2021)
- 33*. Gene Center, Department of Biochemistry, Ludwig Maximilians University, *Munich (Germany)* (2021)
- 32*. IZNF, FAU Erlangen *Erlangen (Germany)* (2021)
- 31*. Laboratoire Architecture et Fonction des Macromolécules Biologiques (AFMB), *Marseille (France)* (2019)
- 30*. Institute for the Biology and Chemistry of Proteins, *Lyon (France)* (2019)
- 29*. Structural Biology and Biophysics Seminar, Basel Biozentrum, *Basel (Switzerland)* (2019)
- 28*. Muenchner Physik Kolloquium, Ludwig Maximilians University, *Munich (Germany)* (2019)
- 27*. Physikalisches Kolloquium, FAU Erlangen-Nuremberg, *Erlangen (Germany)* (2018)
- 26*. Bayern Biophotonics, Max Planck Institute Physics of Light, *Erlangen (Germany)* (2017)
- 25*. GRK1962, FAU Erlangen-Nuremberg, *Erlangen (Germany)* (2017)
- 24*. Department of Virology, FAU Erlangen-Nuremberg, *Erlangen (Germany)* (2017)
- 23*. Laboratoire Architecture et Fonction des Macromolécules Biologiques (AFMB), *Marseille (France)* (2017)
- 22*. Department of Immune Modulation, FAU Erlangen-Nuremberg, *Erlangen (Germany)* (2016)
21. Interdisciplinary Center for Clinical Research (IZKF), FAU Erlangen-Nuremberg, *Erlangen (Germany)* (2015)
20. King's College, *London (UK)* (2015)
19. Centre d'Etudes d'agents Pathogènes et Biotechnologies pour la Santé, *Montpellier (France)* (2015)
18. DIIID Seminar Series, King's College, *London (UK)* (2015)
17. Centre de Biochimie Structurale, *Montpellier (France)* (2015)
16. University of Warwick, *Coventry (UK)* (2015)
15. University of Oxford, *Oxford (UK)* (2014)
14. University of Wollongong, *Wollongong (Australia)* (2013)
13. Centre de Biochimie Structurale, *Montpellier (France)* (2013)
12. Laboratoire Architecture et Fonction des Macromolécules Biologiques (AFMB), *Marseille (France)* (2013)
11. Physics-Biology interface seminar, Laboratoire de Physique Statistique, *Orsay (France)* (2013)
10. Laboratoire de Virologie Moléculaire et Structurale, Gif/Yvette (France) (2012)
9. KNAW Biophysics Meeting, *Amsterdam (The Netherlands)* (2012)
8. Institut Jacques Monod, *University Paris 7, Paris (France)* (2012)
7. Centre de Génétique Moléculaire, Gif/Yvette (France) (2012)
6. Laboratoire Charles Fabry of the Institut d'Optique, *Palaiseau (France)* (2010)
5. Centre de Génétique Moléculaire, Gif/Yvette (France) (2010)
4. TU Delft, *Delft (The Netherlands)* (2009)
3. Amherst University, *Amherst Massachusetts (USA)* (2009)
2. Columbia University, *New-York City (USA)* (2009)
1. Cornell University, *New-York City (USA)* (2009)

Mentorship

Service on PhD examination committees at external institutions

Jetty van Ginkel, TU Delft (The Netherlands)
Olena Parilova, University of Turku (Finland)
Emil Aalto-Setälä, University of Turku (Finland)

Supervision since PI

Vrije Universiteit Amsterdam (The Netherlands)

PhD candidate Pim America

Postdoctoral fellow Misha Klein

Master Student Daniel Buc

Student assistant Eline Bogers

Interdisciplinary Center for Clinical Research (IZKF), FAU Hospital Erlangen-Nuremberg (Germany)

PhD candidate Dr. Mona Seifert (graduated Summa Cum Laude in April 2022)

Research Assistant Dr. Flavia Stal-Papini, Monika Spermann, Eugeniu Ostrofet, Yibulayin Wubulikasimu

Postdoctoral Fellow Dr. Subhas Chandra Bera, Dr. Salina Quack, Dr. Sadegh Feiz

Supervision during Postdocs

Department of Physics, University of Oxford (UK)

PhD candidate Rebecca Andrews

Master Students Martin Kaller, Jacob Bakermans

Department of Bionanosciences, TU Delft (The Netherlands)

Postdoctoral fellow Dr. Zhongbo Yu

PhD candidates Natalia Vtyurina, Bojk A. Berghuis, Aartjan te Velthuis

Master Students Tao Ju Cui, Ruadrith Forbes, Jelmer Cnossen, Ivana Cvijovic, Cristina Sfligoj, Tom Sassen, Matthew Pierotti, Sumit Sachdeva

Bachelor Student Kevin Esajas

Professional Service, Society Membership

Service at University

Since 2021 Member of the Examination board of the B.Sc.-M.Sc. Physics and Astronomy program of Vrije Universiteit and Universiteit van Amsterdam

2020-2021 Member of the FAU-IZKF Junior committee.

Grant Reviewer Agence Nationale pour la Recherche (ANR), European Research Council (ERC), German Research foundation (DFG)

Peer Reviewer for Nature Structural and Molecular Biology, Nature Communications, Angewandte Chemie International Edition, Nucleic Acids Research, Molecular Cell, Methods, FEBS letter, Journal of Biological Chemistry.