# Robert Stein

Curriculum Vitae

Multi-Messenger Astronomy | Tidal Disruption Events | Machine Learning

## Personal Data


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| Place and Date of Birth: | London \| 10 June 1995 |
| Citizenship: | British & Irish |
| Email: | rdstein@caltech.edu |
| Website: | robertdstein.github.io |


## Education

July 2017 – Nov. 2021

PhD in Experimental Physics,
**Humboldt University of Berlin / DESY Zeuthen**
Thesis: "*Search for Multi-Messenger Transients with IceCube and ZTF*"
Research Advisor: A. Franckowiak
Graded "*Summa cum laude*" (with the highest distinction)

- Cross-correlation of neutrinos with multi-wavelength catalogues
- Led response to neutrino alerts as the *IceCube realtime shifter*
- ZTF follow-up of neutrino/gravitational wave/GRB events

Sep. 2013 – June 2017

MSci in Physics with a Year In Europe,
**Imperial College London / University of Hamburg**
Thesis: "*Reconstruction of Charge Number of Heavy Cosmic Rays using Cherenkov Light*"
Research Advisor: D. Horns (University of Hamburg)
Graduated with First Class Honours

## Academic Career

Nov. 2021 – Present

Postdoctoral Scholar in Astronomy,
**California Institute of Technology**
Mentor: M. M. Kasliwal

- ZTF follow-up of neutrino/gravitational wave/GRB events
- WINTER data analysis and multi-messenger follow-up
- Development of TDE photometric classifier: tdescore

## Selected Talks

24th May 2023

Invited Talk, Caltech Astronomy Colloquium, Pasadena, USA
"*Chasing Ghosts: Searching for Electromagnetic Counterparts to High-Energy Neutrinos*"

20th Mar 2023

Invited Plenary Talk, 86th DPG Meeting (SMuK), Dresden, DE
"*Black Holes, Shredded Stars and Cosmic Neutrinos*"

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| 1ST NOV. 2022 | INVITED TALK, PSU GAPP Seminar, State College, USA<br>"*Search for electromagnetic counterparts to high-energy neutrinos*" |
| 27TH OCT. 2022 | INVITED TALK, Cornell SMBH Workshop, Ithaca, USA<br>"*Neutrinos and TDEs*" |
| 29TH SEP. 2022 | INVITED TALK, 18th Vulcano Workshop on Frontier Objects in Astrophysics and Particle Physics, Elba, IT<br>"*A tidal disruption event coincident with a high-energy neutrino*" |
| 16TH SEP. 2022 | INVITED TALK, DESY Astroparticle Seminar, Zeuthen, DE<br>"*WINTER: a new IR telescope for time-domain and multi-messenger science*" |
| 14TH SEP. 2022 | INVITED TALK, IR Astronomy in Antarctica Workshop, FR<br>"*High-energy neutrinos and Tidal Disruption Events*" |
| 19TH AUG. 2022 | INVITED TALK, UMD Seminar, College Park, USA<br>"*Neutrino Follow-up with the Zwicky Transient Facility*" |
| 13TH JULY 2021 | INVITED PLENARY HIGHLIGHT TALK, 38th International Cosmic Ray Conference (ICRC), Berlin, DE<br>"*A tidal disruption event coincident with a high-energy neutrino*" |
| 6TH JULY 2021 | INVITED TALK, AIRUB science seminar, Bochum, DE<br>"*Neutrinos from shredded stars*" |
| 29TH JUNE 2021 | INVITED TALK, European Astronomical Society, Leiden, NL<br>"*Neutrinos from tidal disruption events*" |
| 16TH JUNE 2021 | INVITED TALK, LIGO-GRITTS seminar, Pasadena/Cambridge, USA<br>"*A tidal disruption event coincident with a high-energy neutrino*" |
| 10TH DEC. 2020 | INVITED TALK, Cosmic Rays and Neutrinos in the Multi-Messenger Era, Paris, FR<br>"*Neutrinos from tidal disruption events*" |
| 14TH OCT. 2020 | INVITED TALK, ASTRON Astrolunch, Dwingeloo, NL<br>"*A high-energy neutrino coincident with a tidal disruption event*" |
| 25TH AUG. 2020 | INVITED TALK, NASA GSFC ASD Colloquium, Greenbelt, USA<br>"*A high-energy neutrino coincident with a tidal disruption event*" |
| 5TH JUNE 2020 | INVITED TALK, DESY Astroparticle Seminar, Zeuthen, DE<br>"*A high-energy neutrino coincident with a tidal disruption event*" |
| 26TH OCT. 2019 | INVITED TALK, PAHEN Conference, Berlin, DE<br>"*Neutrinos from optical transients with IceCube*" |
| 30TH JULY 2018 | INVITED TALK, ESO Thirty Minute Talk, Santiago, CL<br>"*ZTF and the AMPEL Broker: Providing a realtime public astronomy survey*" |

## Scholarships, Awards and Honours

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| 11TH May 2023 | Winner of the Global Neutrino Network (GNN) Thesis Prize |
| 22ND Mar 2023 | Winner of the DPG (German Physical Society) Dissertation Prize for the Matter and Cosmos division, DPG Annual Meeting, Dresden |
| 26TH Mar 2021 | Winner of the *IceCube Impact Award*, IceCube Spring 2021 Meeting |
| 2ND July 2020 | Winner of first session poster competition, Neutrino 2020 Conference |
| 16TH Oct 2019 | Winner of the annual DESY Science Slam, DESY Hamburg |
| 21ST Nov 2018 | Winner of the annual Zeuthen Science Slam, DESY Zeuthen |

## Selected Telescope Time Awarded (PI only)

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| Oct. 2023 – Nov. 2023 | Chandra Program (PI) - 25 ks, DDT<br>*Unveiling the nature of a candidate multi-messenger supernova* |
| Aug. 2023 – Jan. 2024 | Palomar P48 + P60 Program (PI) - 18 hours, 1 semester<br>*Uncovering the dustiest transients with ZTF and WINTER* |
| Feb. 2023 – Feb. 2024 | Gemini Program (PI) - 6 hours, 2 semesters<br>*Spectroscopic Classification of Candidate Neutrino Sources* |
| Aug. 2022 – Jul. 2023 | Keck Observatory Program (PI) - 16 hours, 2 semesters<br>*Candidate Neutrino Sources* |
| June 2020 – Nov. 2020 | Very Large Array Program (PI) - 6 hours, DDT<br>*VLA observations to establish the neutrino counterpart to a giant AGN flare* |

## Selected Professional Responsibilities

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| 2021 – Present | Journal Referee<br>*ApJ, MNRAS, PASP* |
| 2021 – Present | Proposal Referee and TAC Member<br>*JCMT (referee), Gemini (referee), Caltech Palomar/Keck (TAC)* |
| Aug. 2023 – Present | LOC / SOC Member<br>*ZTF Collaboration Meeting (Caltech), Caltech-LANL TDA Workshop* |
| May 2022 – Aug. 2023 | ZTF AGN/TDE Working Group Chair |
| Nov. 2022 – Present | ZTF MMA Working Group Co-Convenor |
| Oct. 2022 – Present | ZTF Publication Board Member |

## Supervision, Teaching and Outreach

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| Jun. 2023 – July 2023 | Supervision of high-school students for summer research projects: A. Drake, S. Sutanto, N. Lam |
| Jun. 2022 – August 2022 | Supervision of summer undergraduate research fellow: L. Yang<br>*Hunting for Kilonovae with ZTF and SkyPortal* |
| Oct. 2019 – Oct. 2020 | Supervision of master's degree student: J. Necker<br>*Search for high-energy neutrinos from core-collapse supernovae* |
| Sep. 2019 – Sep. 2020 | Supervision of master's degree student: R. Naab<br>*The next-generation Optical Follow-Up (OFU) program for IceCube* |
| Oct 2018 – Aug. 2019 | Supervision of bachelor's degree student: A. Vagts<br>*Investigation of the TXS 0506+056 neutrino spectrum* |

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| July 2022 - July 2023 | Lecturer: *Annual ZTF Summer School* (2 years) |
| June 2018 – July 2019 | Teaching Assistant: *Experimental Astroparticle Physics* (2 semesters) |

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| Aug. 2023 | Presenter: *Astronomy on Tap* |
| Oct. 2018 – Nov. 2019 | Volunteer: *International Cosmic Day* (2 years) |
| June 2018 – June 2019 | Volunteer: *Lange Nacht der Wissenschaft* (2 years) |
| March 2018 | Organiser: *IceCube Masterclass* |

## Additional Information

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| **Collaboration Membership** | WINTER, ZTF, GROWTH, LSST-TVSSC |
| **Programming Skills:** | Python, PostgreSQL, LaTeX, Bash, git (Advanced) |
| **Language Skills:** | English (Native Speaker), German (Advanced - C1) |
| **Observing Experience:** | Keck: LRIS, NIRES, DEIMOS (8 nights)<br>Palomar: WIRC, DBSP, TSpec (13 nights)<br>La Silla: NTT (8 nights) |

## Professional References

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| **Professor Anna Franckowiak** (RUB) | franckowiak@astro.ruhr-uni-bochum.de |
| **Professor Mansi Kasliwal** (Caltech) | mansi@astro.caltech.edu |
| **Professor Matthew Graham** (Caltech) | mjg@caltech.edu |

## Selected Publications (*peer-reviewed)

- Full list available at Google Scholar

**2023** *Neutrino Follow-Up with the Zwicky Transient Facility*
*__R. Stein__ et al., MNRAS, Volume 521, Issue 4

*Constraining High-energy Neutrino Emission from Supernovae with IceCube*
*IceCube Collaboration, ApJL 949 L12
- **R. Stein** as one of three credited authors

*Establishing accretion flares from massive black holes as a major source of high-energy neutrinos*
S. van Velzen, **R. Stein** et al., (submitted)

*tdescore: An Accurate Photometric Classifier for Tidal Disruption Events*
**R. Stein** et al. (under internal ZTF review)

*Limits on the astrophysical neutrino flux using GRB221009A*
**R. Stein** (in prep.)

*SN2023uqf: a candidate multi-messenger supernova*
**R. Stein** (in prep.)

*A data reduction pipeline for WINTER using the mirar framework*
**R. Stein** et al. (in prep.)

**2022** *ASAS-SN follow-up of IceCube high-energy neutrino alerts*
*J. Necker, T. de Jaegar, **R. Stein** et al., MNRAS, Volume 516, Issue 2

*The candidate tidal disruption event AT2019fdr coincident with a high-energy neutrino*
*S. Reusch, **R. Stein** et al., Phys. Rev. Lett. 128, 221101

*A tidal disruption event neutrino coincident with a high-energy neutrino*
*__R. Stein__ et al., 2021, Nat Astron 5, 510-518

**2020** *Kilonova Luminosity Function Constraints based on Zwicky Transient Facility searches for 13 Neutron Star Mergers*
*M. M. Kasliwal, S. Anand, T. Ahumada **R. Stein** et al., ApJ, 905, 145

**2019** *Search for Neutrinos from Populations of Optical Transients*
, **R. Stein** for the IceCube Collaboration, PoS(ICRC2019)1016

## Selected Software

**2023** **R. Stein** et al., *Mirar*
*Photometric reduction code, used for WINTER, SEDmV2 and DREAMS.*

**2020** **R. Stein** et al., *NuZTF*, DOI: 10.5281/zenodo.4048335
*ZTF MMA analysis code, used for neutrino, GW and GRB searches.*

**R. Stein** et al., *Flarestack*, DOI: 10.5281/zenodo.3619383
*Likelihood analysis code for neutrino correlation studies*