

# Ramandeep Gill

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## Research Interests

- **EM signatures of compact object mergers:** Merger remnants and their lifetimes, kilonova physics, relativistic jet launching, dynamics, and prompt and afterglow emission.
- **GRB and AGN jets:** Spectral modeling of jets, radiation transfer, kinetic simulations, MHD simulations of jets, jet geometry and composition, high energy processes
- **Fast radio bursts:** Physics of FRBs in strong magnetic field plasmas
- **Neutron stars:** Magnetic field decay, magnetar bursts, population synthesis, neutron star cooling, Pulsar/magnetar wind nebulae
- **Relativistic plasmas:** Plasma waves, mode coupling to radiation, turbulence, magnetic reconnection, cosmic-rays, MHD simulations
- **Axions:** Constraints on axion properties from astrophysical sources, polarization measurements, and blazars

## Employment

- **Instituto de Radioastronomía y Astrofísica** 2021 - Present  
Assistant Professor
- **The George Washington University** 2019 - 2021  
Postdoctoral Fellow
- **The Open University of Israel** 2015 - 2021  
Postdoctoral Fellow
- **Institute for Theoretical Physics, Goethe University** 2018 - 2019  
Visiting Research Scholar
- **Canadian Institute for Theoretical Astrophysics** 2012 - 2015  
Postdoctoral Fellow

## Education

- **PhD in Astrophysics** Nov, 2012  
University of British Columbia  
Thesis: *Astrophysical Plasmas Near Strongly Magnetized Compact Objects*  
Advisor: *Prof. Jeremy Heyl*
- **BSc in Physics and Astronomy (Hons.)** 2007  
University of British Columbia

## Grants

- PAPIIT 2023 - 2024

## Awards

- Open University of Israel Fellowship 2017 - 2018
- 100,000 cpu hrs on SuperMUC supercomputer 2017
- 100,000 cpu hrs on HazelHen supercomputer 2017
- University Research Fund (OUI) 2016 - 2017
- Outstanding Postdoctoral Researcher Fellowship (OUI) 2015 - 2016
- CITA Fellowship 2012 - 2015
- NSERC Canada Graduate Scholarship 2009 - 2012
- Four Year Fellowship (UBC) 2009 - 2012
- Graduate Research Mobility Award (UBC) 2009
- Graduate Entrance Scholarship (UBC) 2007

## Teaching & Outreach Experience

- Taught a graduate course on The Physics of Gamma-Ray Bursts 2022
  - Gave weekly lectures and assignments
- Taught a graduate course on Radiative Processes in Astrophysics 2022
  - Gave weekly lectures and assignments
- Supervised a Masters student thesis 2022
  - Developed a computer code for simulations with the student
  - Mentored the student on the physics of gamma-ray bursts
- Wrote scientific articles for the general public in Mexico 2022
  - Wrote two articles on famous scientists as part of the Noche de las Estrellas
- Mentored PhD student at the University of Toronto 2013 - 2014
  - Gave tutorials on high-energy radiative processes in astrophysics
  - Showed the student how to simulate radiative processes using a computer code
- Teaching assistant for 1<sup>st</sup>-year astronomy lab course at UBC 2007 - 2009
  - Delivered lectures on introductory topics in astronomy
  - Helped students in carrying out lab experiments and understanding core concepts
- Tours of the night sky using the 14-inch UBC telescope 2007 - 2012
  - Gave public tours of the night sky every clear Saturday/Sunday night
  - Showed Venus, Mars, Jupiter, Saturn, Andromeda galaxy, globular clusters, etc.
  - Answered general questions about the planets, stars, and the Universe.
- Lecturer for astronomy summer school at UBC 2010
  - Gave lectures on introductory astronomy to elementary school students
  - Designed and administered various experiments, e.g. bottle rocket, diptych dial, etc.

## Publications

1. **Gill, R.** and Granot, J. [Prompt GRB Polarization from Non-Axisymmetric Jets](#), 2023, MNRAS, Submitted
2. Arimoto, M., Asano, K., Kawabata, K. S., Toma, K., **Gill, R.**, et al. [Gamma rays from a reverse shock with turbulent magnetic fields in GRB 180720B](#), 2023, in press, Nature Astronomy
3. **Gill, R.** and Granot, J. [GRB 221009A Afterglow from a Shallow Angular Structured Jet](#), 2023, MNRAS Letters, 524, L78 [Cite: 5]
4. O'Connor, B., Troja, E., Ryan, G., Beniamini, P., van Eerten, H., Granot, J., Dichiara, S., Ricci, R., Lipunov, V., Gillanders, J. H., **Gill, R.**, et al. [A structured jet explains the extreme GRB 221009A](#), 2023, Sci. Adv., 9, eadi1405 [Cite: 24]
5. Fermi-GBM et al. [Fermi-GBM Discovery of GRB 221009A: An Extraordinarily Bright GRB from Onset to Afterglow](#), 2023, ApJ Letters, 952L, 42 [Cite: 25]
6. Kumar, P., **Gill, R.**, & Lu, W. Propagation of Alfvén waves in the charge starvation regime, 2022, MNRAS, 516, 2697 [Cite: 7]
7. Beniamini, P., **Gill, R.**, & Granot, J. [Robust Features of Off-Axis Gamma-Ray Burst Afterglow Lightcurves](#), 2022, MNRAS, 515, 555 [Cite: 11]
8. **Gill, R.** & Granot, J. [Gamma-Ray Bursts at TeV Energies: Theoretical Considerations](#), 2022, Galaxies, 10, 74 [Cite: 10]
9. **Gill, R.**, Sonbas, E., Dhuga, K. S., and Göğüş, E. [The Disk-Corona Model and Mass Estimates of the Ultraluminous X-ray Source Holmberg IX X-1](#), 2021, ArXiv:2111.13316 [Cite: 1]
10. The Gamow Explorer Team. [The Gamow Explorer: A gamma-ray burst observatory to study the high redshift universe and enable multi-messenger astrophysics](#), 2021, Proc. SPIE 11821 [Cite: 12]
11. **Gill, R.**, Kole, M., & Granot, J. [GRB Polarization: A Unique Probe of GRB Physics](#), 2021, Galaxies, 9, 82 [Cite: 23]
12. **Gill, R.** & Granot, J. [Temporal Evolution of Prompt GRB Polarization](#), 2021, MNRAS, 504, 1939 [Cite: 12]
13. Fermi Collaboration. [High-Energy Emission from a Magnetar Giant Flare in the Sculptor Galaxy](#), 2021, Nature Astronomy, 5, 385 [Cite: 20]
14. Nathanail, A., **Gill, R.**, Porth, O., Fromm, C. M., & Rezzolla, L. [3D magnetised jet breakout from neutron-star binary merger ejecta: afterglow emission from the jet and the ejecta](#), 2021, MNRAS, 502, 1843 [Cite: 37]
15. **Gill, R.**, Granot, J., & Beniamini, P. [GRB Spectrum from Gradual Dissipation in a Magnetized Outflow](#), 2020, MNRAS, 499, 1356 [Cite: 14]

16. Nathanail, A., **Gill, R.**, Porth, O., Fromm, C. M., & Rezzolla, L. [On the opening angle of magnetised jets from neutron-star mergers: the case of GRB170817A](#), 2020, MNRAS, 495, 3780 [Cite: 28]
17. Beniamini, P., Granot, J., & **Gill, R.** [Afterglow Lightcurves from Misaligned Structured Jets](#), 2020, MNRAS, 493, 3521 [Cite: 60]
18. **Gill, R.** and Granot, J. [Constraining the magnetic field structure in collisionless relativistic shocks with a radio afterglow polarization upper limit in GW170817](#), 2020, MNRAS, 491, 5815 [Cite: 37]
19. **Gill, R.**, Granot, J., & Kumar, P. [Linear polarization in gamma-ray burst prompt emission](#), 2020, MNRAS, 491, 3343 [Cite: 37]
20. Fermi Collaboration. [Fermi and Swift Observations of GRB 190114C: Tracing the Evolution of High-Energy Emission from Prompt to Afterglow](#), 2019, ApJ, 890, 9 [Cite: 47]
21. MAGIC & Fermi Collaboration. [Observation of inverse Compton emission from a long gamma-ray burst](#), 2019, **Nature**, 575, 459 [Cite: 140]
22. Laskar, T., Alexander, K. D., **Gill, R.** et al. [ALMA Detection of a Linearly Polarized Reverse Shock in GRB 190114C](#), 2019, ApJL, 878, L26 [Cite: 56]
23. **Gill, R.**, Granot, J., De Colle, F., & Urrutia, G. [Numerical Simulations of an Initially Top-Hat Jet and the Afterglow of GW170817/GRB170817A](#), 2019, ApJ, 883, 15 [Cite: 34]
24. **Gill, R.**, Nathanail, A., & Rezzolla, L. [When Did the Remnant of GW170817 Collapse to a Black Hole?](#), 2019, ApJ, 876, 139 [Cite: 86]
25. eXTP Collaboration. [Observatory Science with eXTP](#), 2019, SCPMA, 62, 42 [Cite: 38]
26. Granot, J., **Gill, R.**, Guetta, D., & De Colle, F. [Off-axis emission of short GRB jets from double neutron star mergers and GRB 170817A](#), 2018, MNRAS, 481, 1597 [Cite: 89]
27. Vianello, G., **Gill, R.**, Granot, J. Omodei, N., Cohen-Tanugi, J., & Longo, F. [The Bright and the Slow – GRBs 100724B & 160509A with High-energy Cutoffs at  \$\lesssim 100\$  MeV](#), 2018, ApJ, 864, 163 [Cite: 57]
28. **Gill, R.** & Granot, J. [Afterglow Imaging and Polarization of Misaligned Structured GRB Jets and Cocoon: Breaking the Degeneracy in GRB 170817A](#), 2018, MNRAS, 478, 4128 [Cite: 100]
29. **Gill, R.** & Granot, J. [The Effect of Pair Cascades on the High-Energy Spectral Cutoff in Gamma-Ray Bursts](#), 2018, MNRAS Letters, 475, 1 [Cite: 18]
30. **Gill, R.**, Granot, J., & Lyubarsky, Y. [2D Relativistic MHD Simulations of the Kruskal-Schwarzschild Instability in a Relativistic Striped Wind](#), 2018, MNRAS, 474, 3535 [Cite: 13]
31. Fermi Collaboration. [Fermi-LAT Observations of LIGO / Virgo Event GW170817](#), 2018, ApJ, 861, 85 [Cite: 30]
32. Granot, J., Guetta, D. & **Gill, R.** [Lessons from the short GRB170817A – the First Gravitational Wave Detection of a Binary Neutron Star Merger](#), 2017, ApJL, 850, 24 [Cite: 80]

33. Younes, G., Kouveliotou, C., Jaodand, A., Baring, M. G., van der Horst, A. J., Harding, A. K., Hessels, J. W. T., Gehrels, N., **Gill, R.**, Huppenkothen, D., Granot, J., Göğüş, E., & Lin, L. [X-ray and radio observations of the magnetar SGR J1935+2154 during its 2014, 2015, and 2016 outbursts](#), 2017, ApJ, 847, 15 [Cite: 59]
34. Göğüş, E., Lin, L., Roberts, O. J., Chakraborty, M., Kaneko, Y., **Gill, R.**, Granot, J., van der Horst, A. J., Watts, A. L., Baring, M. G., Kouveliotou, C. Huppenkothen, D., & Younes, G. [Burst and Outburst Characteristics of Magnetar 4U 0142+61](#), 2017, ApJ, 835, 68 [Cite: 5]
35. Fermi Collaboration. [Searching the Gamma-ray Sky for Counterparts to Gravitational Wave Sources: Fermi GBM and LAT Observations of LVT151012 and GW151226](#), 2017, ApJ, 835, 82 [Cite: 50]
36. Granot, J., **Gill, R.**, Younes, G., Gelfand, J., Harding, A., Kouveliotou, C., & Baring, M. G. [Learning About the Magnetar Swift J1834.9-0846 from its Wind Nebula](#), 2017, MNRAS, 464, 4895 [Cite: 23]
37. Guiriec, S., Kouveliotou, C., Hartmann, D. H., Granot, J., Asano, K., Meszaros, P., **Gill, R.**, Gehrels, N., & McEnery, J. [A Unified Model for GRB Prompt Emission from Optical to Gamma-Rays; a New Type of Standard Candle](#), 2016, ApJ, 831L, 8 [Cite: 25]
38. Younes, G., Kouveliotou, C., Kargaltsev, O., **Gill, R.**, Granot, J., Watts, A. L., Gelfand, J., Baring, M. G., Harding, A., Pavlov, G. G., van der Horst, A. J., Huppenkothen, D., Göğüş, E., Lin, L., & Roberts, O. J. [The wind nebula around magnetar Swift J1834.9-0846](#), 2016, ApJ, 824, 138 [Cite: 50]
39. Thompson, C. & **Gill, R.** [Pulse Structure of Hot Electromagnetic Outflows with Embedded Baryons](#), 2014, ArXiv:1406.5239 [Cite: 4]
40. **Gill, R.** & Thompson, C. [Non-Thermal Gamma-Ray Emission from Delayed Pair-Breakdown in a Magnetized and Photon-Rich Outflow](#), 2014, ApJ, 796, 81 [Cite: 23]
41. Thompson, C. & **Gill, R.** [Hot Electromagnetic Outflows. III. Displaced Fireball in a Strong Magnetic Field](#), 2014, ApJ, 791, 30 [Cite: 26]
42. **Gill, R.** & Heyl, J. [Statistical Ages and the Cooling Rate of X-Ray Dim Isolated Neutron Stars](#), 2014, MNRAS, 435, 3243 [Cite: 5]
43. **Gill, R.** & Heyl, J. [Constraining the Photon-Axion Coupling Constant with Magnetic White Dwarfs](#), 2011, PRD, 84, 085001 [Cite: 34]
44. Heyl, J., **Gill, R.** & Hernquist, L. [Cosmic Rays from Pulsars and Magnetars](#), 2010, MNRAS, 406, L25 [Cite: 20]
45. **Gill, R.** & Heyl, J. [On the Trigger Mechanisms of Soft Gamma-Repeater Giant Flares](#), 2010, MNRAS, 407, 1926 [Cite: 40]
46. **Gill, R.** & Heyl, J. [Dispersion Relations for Bernstein Waves in a Relativistic Plasma](#), 2009, PRE, 80, 036407 [Cite: 9]
47. **Gill, R.** & Heyl, J. [The Birthrate of Magnetars](#), 2007, MNRAS, 381, 52 [Cite: 35]

## Conferences, Seminars, & Workshops

1. **Invited Talk:** Bringing Theory into the Data Space, Geneva, Switzerland  
Title: *Spectro-Polarimetric Modeling of GRBs and Their Afterglows* 2023
2. **Talk:** GRB50: The Past, Present, and Future of Gamma-Ray Bursts, Warrenton, USA  
Title: *Steep and Shallow Jet Angular Structures Revealed by the Afterglows of Gamma-Ray Bursts* 2023
3. **Poster:** GRB50: The Past, Present, and Future of Gamma-Ray Bursts, Warrenton, USA  
Title: *Time-Dependent Linear Polarization Models of Prompt and Afterglow Emission in Gamma-Ray Bursts* 2023
4. **Invited Talk:** 19th Rencontres du Vietnam, Quy Nhon, Vietnam  
Title: *GRB Polarization: Theoretical Overview & Current Status* 2023
5. **Invited Online Talk:** Institute of Astrophysics Colloquium, Forth, Greece  
Title: *Angular Structure of Ultra-Relativistic Jets in GRBs* 2022
6. **Talk:** PASTO - Particle Acceleration in Astrophysical Objects, Rome, Italy  
Title: *Prompt GRB Polarization: Temporal Evolution & Energy Dependence* 2022
7. **Talk:** Astrophysical Polarimetry in the Time-Domain Era, Lecco, Italy  
Title: *Temporal Evolution of Prompt GRB Polarization* 2022
8. **Invited Talk:** Colloquium at IRyA  
Title: *Angular Structure of Jets in Gamma-Ray Bursts* 2022
9. **Invited Online Talk:** Seminar at ARCO  
Title: *Prompt GRB Polarization* 2022
10. **Invited Review Talk:** 16<sup>th</sup> Marcel Grossmann Meeting, Rome.  
Title: *Emission from Structured GRB Jets: Theoretical Overview* 2021
11. **Invited Online Talk:** High-Energy Astrophysics Seminar Series, UNAM, Mexico  
Title: *Gamma-ray bursts: The mystery being resolved & new prospects* 2020
12. **Invited Talk:** Ioffe Workshop on GRBs and other transient sources: 25 Years of Konus-Wind Experiment, St Petersburg, Russia.  
Title: *Constraints on the binary NS merger remnant and outflow structure from EM counterparts of GW170817* 2019
13. **Invited Talk:** Workshop to bring together experts on High Energy Astrophysics from Japan and Israel, Japan.  
Title: *Polarization and afterglow of structured outflows: Insights gained from GW170817/GRB 170817A* 2019

- Invited Talk:** Astronomy & Astrophysics Seminar, TIFR-Mumbai.
14. Title: *Insights gained from GW170817/GRB 170817A: BNS merger remnant and outflow structure* 2019
- Gamma-Ray Bursts and Related Astrophysics in Multi-Messenger Era, Nanjing, China.
15. Title: *BNS merger remnant and outflow structure: Insights gained from GW170817/GRB 170817A* 2019
- Invited Talk:** Shedding new light on Gamma-Ray Bursts with polarization data, Geneva.
16. Title: *Polarization of Gamma-Ray Burst Prompt Emission: An Overview* 2018
- Invited Talk:** EXPUNIV 2018, Kolkata.
17. Title: *Probing the GRB prompt emission mechanism, magnetic field geometry, and jet structure with linear polarization* 2018
- Invited Talk:** AstroCoffee, Goethe University, Frankfurt.
18. Title: *GRB 170817A / GW 170817: Constraining the Relativistic Outflow Structure and the Compact Remnant* 2018
- Invited Talk:** 15<sup>th</sup> Marcel Grossmann Meeting, Rome.
19. Title: *GRB 170817A / GW 170817: Constraining the Relativistic Outflow Structure and the Compact Remnant* 2018
- 15<sup>th</sup> Marcel Grossmann Meeting, Rome.
20. Title: *The Effect of Pair Cascades on the High-Energy Spectral Cutoffs in GRBs* 2018
- Invited Talk:** Astrolunch at the Hebrew University of Jerusalem.
21. Title: *GRB Jets: Acceleration, Dissipation, & Radiation* 2018
- Deciphering the Violent Universe, Cancún, Mexico. Title: *Lessons from the short GRB 170817A and off-axis emission from GRB jets* 2017
- 22.
- High Energy Astrophysics Workshop, HUJI, Jerusalem. Title: *On the origin of the GeV/TeV emission from H.E.S.S. J1834-087* 2017
- 23.
- National Israeli Astronomy Seminar, Tel Aviv University. Title: *What's Powering the Magnetar Wind Nebula Around Swift J1834.9-0846?* 2017
- 24.
- PiTP Summer School on *Computational Plasma Astrophysics*, Institute for Advanced Study, Princeton 2016
- 25.
- Dynamical Processes in Space Plasmas, Dead Sea, Israel. Title: *GRB Prompt-phase Spectrum in High Sigma Outflows* 2016
- 26.
- AAS HEAD Meeting, Naples, Florida. Title: *A Magnetar Wind Nebula: Is the Spin-down-powered Wind Enough?* 2016
- 27.

28. **Invited Talk:** Ben Gurion University of the Negev. Title: *A Two-Zone Model for GRB Prompt Emission in Strongly Magnetized Outflows* 2016
29. The Racah Institute of Physics, HUJI. Title: *A Two-Zone Model for GRB Prompt Emission in Strongly Magnetized Outflows* 2015
30. CASCA 2015. McMaster University. Title: *Gamma-ray bursts from strongly magnetized outflows with dissipation from a baryon shell* 2015
31. CITA. Title: *The Spectral States of Black Hole X-Ray Binaries* 2014
32. The Structure and Signals of Neutron Stars: From Birth to Death. Florence. Title: *Statistical Ages and the Cooling Rate of XDINS* 2014
33. CITA. Title: *Models of GRBs* 2014
34. CASCA 2013. Vancouver. Title: *Study of High Energy Processes in Relativistic Plasmas Near Compact Objects* 2013
35. 8th Patras Workshop on Axions, WISPS, WIMPS. Chicago. Title: *Constraints on Axion-Like Particles From Magnetic White Dwarfs* 2012
36. Canadian Workshop on the Nuclear and Astrophysics of Stars. TRIUMF. Title: *Axion Properties from White Dwarf Magnetospheres* 2010
37. Theory Seminar. TRIUMF. Title: *Mystery solved: Cosmic rays from pulsars and magnetars can explain ATIC, H.E.S.S., PAMELA, and Fermi observations* 2010
38. 24th Texas Symposium on Relativistic Astrophysics. Vancouver. Title: *The Birthrate of Magnetars* 2008

### Academic Associations

1. Fermi-LAT Collaboration
2. eXTP - enhanced X-ray Timing and Polarimetry mission
3. POLAR - 1 & 2

### Computer Skills

1. Linux/Unix, C, Fortran, Python, Mathematica

### Academic Services

1. Referee for Journals: Science, ApJ, Physical Review B, MNRAS, JCAP, Galaxies
2. Panelist for NASA/Fermi Proposal Selection

### References



**Prof. Jeremy Heyl**

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