

Curriculum Vitae

Kenji Toma

(Mar 3, 2025)

Gender: Male

Birth: March 8, 1979; [Place] Osaka, Japan

Nationality: Japanese

Work address:

Frontier Research Institute for Interdisciplinary Sciences, Tohoku University, Sendai
560-0043, Japan

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Research Topics: Theoretical Astrophysics

Dynamics of relativistic jets and accretion flows, gamma-ray bursts, active galactic nuclei, supernovae, black holes, neutron stars, non-thermal particle acceleration and radiation processes, first generation stars and observational cosmology, observational tests of fundamental physics

Education:

Apr 2005-- Mar 2008: Ph.D., Physics, Kyoto University, Japan (Supervisor: Prof. Takashi Nakamura) ``Probing the Efficiency of Electron-Proton Coupling in Collisionless Shocks through the Radio Polarimetry of Gamma-Ray Burst Afterglows"

Apr 2003-- Mar 2005: M.Sc., Physics, Kyoto University, Japan (Supervisor: Prof. Takashi Nakamura) ``A Possible Origin of Bimodal Distribution of Gamma-Ray Bursts"

Apr 1997-- Mar 2001: B.Sc., Physics, Kyoto University, Japan

Employments & Fellowships:

Oct 2023— Professor, Tohoku University

Apr 2018—Sep 2023 Associate Professor, Tohoku University

(Sep 2015---Jan 2016 Visiting Researcher in University of Leeds, UK)

Dec 2013—Mar 2018 Assistant Professor, Tohoku University

Apr 2011—Nov 2013 Superlative Posdoc of JSPS Research Fellowships (Supervisor: Prof. Fumio Takahara)

Oct 2008—Mar 2011 Postdoctoral Fellow, Pennsylvania State University, USA
 (Supervisor: Prof. Peter Meszaros)
 Apr 2008—Sep 2008 Reseacher, National Astronomical Observatory of Japan
 Apr 2006—Mar 2008 JSPS Research Fellow (Doctoral Course)
 (JSPS = Japan Society for the Promotion of Science)

Research Grants:

Apr 2018---Mar 2022 JSPS Grants-in-Aid for Scientific Research, ``Verification of the driving mechanism of black hole jets by utilizing the high resolution radio observation data'', 2,300,000 JPY (for 2018) + 3,600,000 JPY per year
 Apr 2015---Mar 2017 JSPS Grants-in-Aid for Scientific Research, ``Revealing the Driving Mechanism of Black Hole Jets through Polarization and General Relativistic Electrodynamics Theories'', 2,500,000 JPY per year
 Apr 2011—Mar 2014 Research grant for JSPS fellows, No.231446, ``Revealing the Origins of Gamma-Ray Bursts'', 2,500,000 JPY per year
 Sep 2009—Oct 2010 Co-I., NASA Fermi GI program (Cycle 2, ID 21312), ``Theoretical Models of Gamma-Ray Bursts in Light of the Fermi LAT-GBM Observations'', \$ 90,000
 Apr 2006—Mar 2008 Research grant for JSPS fellows, No.182666, ``A Unification Model of Gamma-Ray Bursts'', 900,000 JPY per year

Awards:

The Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology, the Young Scientists' Prize
 Young Scientist Award of the Physical Society of Japan
 ASJ (Astronomical Society of Japan) Young Astronomer Award

Professional Services:

Jan 2018-- Event Horizon Telescope Collaboration
 Oct 2012-- X-ray and gamma-ray polarimeter mission PolariS group
 Oct 2011-- Hiroshima University Kanata telescope group
 Oct 2011-- GRB polarimeter (GAP) group
 Nov 2009-- Cherenkov telescope mission CTA group
 Jun 2009-- Gamma-ray polarimeter mission POLAR group

Sep 2008--Apr 2011 Fermi satellite, GRB team

Feb 2008-- X/gamma-ray polarimeter mission POET group

Scientific organization committee of international conference

- Astrophysical Polarimetry in the Time-Domain Era, Lecco, Italy, Aug 29-Sep 1, 2022
- Black Hole Astrophysics with VLBI: Multi-wavelength and Multi-messenger Era, ICRR, University of Tokyo, Jan 18-20, 2021
- Dawn of a New Era for Black Hole Jets in Active Galaxies, Tohoku University, Japan, Jan 25-27, 2018
- 2nd Core-U International Conference: Cosmic Polarimetry from Micro to Macro Scales, Hiroshima University, Japan, Feb 17-18, 2017
- IAU Symposium 324: New Frontiers in Black Hole Astrophysics, Slovenia, Sep 12-16, 2016

Referee for scientific journals:

Astrophysical Journal; Monthly Notices of the Royal Astronomical Society; Astronomy & Astrophysics; Astronomical Notes (Astronomische Nachrichten); Progress of Theoretical and Experimental Physics; Publication of Astronomical Society of Japan; Galaxies; Symmetry

Presentations at International Conferences:

1. Toma, K. (invited), "Theory of multi-wavelength flares from black hole magnetospheres and strategy of joint monitoring observations of M87 with global VLBI, Swift and CTA", CTA-Japan Workshop 2024, Jan 8, 2025
2. Toma, K. (invited), "Discussion: theoretical outlook on the future of GRB polarization", GRB Forum 2024, Athens, Greece, July 11, 2024
3. Toma, K. (invited), "GRB Prompt Emission Polarization", New Evolution of Multi-messenger Astrophysics, Penn State, USA, Aug 21, 2023
4. Toma, K. (oral), "Magnetic reconnection in black hole magnetospheres: lepton loading in to jets and superluminal radio blobs", APRIM 2023, Koriyama, Japan, Aug 8, 2023
5. Toma, K. (oral), "Magnetic reconnection in black hole magnetospheres as an origin of superluminal radio blobs", EHT Collaboration Meeting Summer 2023, Taiwan, June 27, 2023

6. Toma, K. (poster), “Hadronic emission in disk and pair-creation gap in jet”, Polarized Radiation near Supermassive Black Holes, Princeton Center for Theoretical Science, USA (online), May 13, 2021
7. Toma, K. (invited talk), “Polarimetric Studies of GRBs, AGN Jets, and Axion Dark Matter”, AIU Symposium 360: Astronomical Polarimetry 2020, Hiroshima, Japan, Mar 26, 2021
8. Toma, K. (invited talk), “Recent Topics in High Energy Astrophysics”, 14th Asia-Pacific Physics Conference, Kuching, Malaysia, Nov 20, 2019
9. Toma, K. (invited talk), “GRB polarization: an overview”, ‘Gamma-Ray Bursts in the Gravitational Wave Era 2019’, Yokohama, Oct 30, 2019
10. Toma, K. (invited talk), “M87 black hole shadow image and its connection with the radio jet”, High Energy Astrophysics Japan Israel Workshop, RIKEN, Jul 19, 2019
11. Toma, K. (invited talk), “Formation and dissipation mechanisms of AGN jets”, ‘Jet and Shock Breakouts in Cosmic Transients’, Kyoto, May 17, 2018
12. Toma, K. (invited talk), “Theoretical and Observational Studies on Relativistic Jets Driven by Black Holes”, ‘27th Workshop on General Relativity and Gravitation in Japan’, Hiroshima U, Nov 27, 2017
13. Toma, K. (invited talk), “Theoretical Studies of GRBs with Multi-wavelength polarimetry”, ‘2nd Core-U International Conference: Cosmic Polarimetry from Micro to Macro Scales’, Hiroshima U, Feb 18, 2017
14. Toma, K. (invited talk), “Acceleration and Collimation of Relativistic Jets”, ‘Challenges of AGN Jets’, NAOJ, Mitaka, Jan 19, 2017
15. Toma, K., Urata, Y. (invited talk), “Radio Polarimetric Study of Gamma-Ray Bursts”, ‘SMA science in the next decade’, ASIAA, Taiwan, Oct 28, 2016
16. Toma, K., Takahara F. (oral), “Causal Production of the Electromagnetic Energy Flux in Blandford-Znajek process”, ‘IAU324: New Frontiers in Black Hole Astrophysics’, Ljubljana, Slovenia, Sep 13, 2016
17. Toma, K., Takahara F. (oral), “Causal Production of the Electromagnetic Energy Flux in Blandford-Znajek process”, ‘M87 Workshop’, ASIAA, Taiwan, May 24, 2016
18. Toma, K. Takahara F. (oral), “Relation between the Blandford-Znajek process and Penrose process”, ‘Relativistic Jets: Creation, Dynamics, and Internal Physics’, Krakow, Poland, Apr 20, 2015
19. Toma, K. (invited talk), “First Stars Signatures in GRBs”, ‘ISSI-BJ workshop: GRBs: A Tool to Explore the Young Universe’, Beijing, China, Apr 14, 2015
20. Toma, K. (oral), “Probing the GRB Emission Mechanism through the gamma- and X-ray polarimetry”, ‘Supernovae and Gamma-ray Bursts in Kyoto’, Kyoto, Nov 2013

21. Toma, K., Takahara F. (oral), "Efficient Acceleration of Relativistic MHD Jets",
`Gravitational Waves: Revolution in Astronomy & Astrophysics', Kyoto, June 2013
22. Toma, K. (invited talk) "Polarization of GRB Prompt Emission", `GRB 2013',
Nashville, Tennessee, USA, Apr 2013 (Toma, eConf Proceedings C1304143,
arXiv:1308.5733)
23. Toma, K. (invited talk) ``Strict Limit on CPT Violation from Polarization of
Gamma-Ray Bursts'', `TeVPA 2012', Mumbai, India, Dec 2012
24. Toma, K. (invited talk) ``Population III GRBs and their Afterglows'', `13th Marcel
Grossman Meeting', Stockholm, Sweden, July 2012
25. Toma, K. (invited talk) ``Polarization of GRB Prompt Emission and Early
Afterglows'', `13th Marcel Grossman Meeting', Stockholm, Sweden, July 2012
26. Toma, K., Takahara F. (oral) ``Baryon Loading of AGN Jets Mediated by Neutrons'',
`Black Holes by the Black Sea', Istanbul, Turkey, June 2012
27. Toma, K. (invited talk) ``Recent Progress in GRB study'', `HEAP2011', Tsukuba
KEK, Japan, Nov 2011
28. Toma, K., Sakamoto, T., Meszaros, P. (invited talk) ``Population III Gamma-Ray
Bursts'', `GRBs As Probes', Como, Italy, May 2011 (Toma et al., MSAIS, 21, 76
(2012))
29. Toma, K., Wu, X.-F., Meszaros, P. (oral) ``A Photosphere-Internal Shock Model of
Gamma-Ray Bursts: Implications for the Fermi/LAT Results'', `Gamma-Ray Bursts
2010', Annapolis, USA, Nov 2010
30. Toma, K., Wu, X.-F., Meszaros, P. (poster) ``A Photosphere-Internal Shock Model of
Gamma-Ray Bursts: Implications for the Fermi/LAT Results'', `The First Galaxies,
Quasars, and Gamma-Ray Bursts', PSU, USA, June 2010
31. Toma, K., Wu, X.-F., Meszaros, P. (poster), ``An External Inverse Compton Emission
Model of Gamma-Ray Burst High-Energy Lags'', `2009 Fermi Symposium',
Washington DC, USA, Nov 2009 (Toma et al., eConf Proceedings C091122,
arXiv:0912.3277)
32. Toma, K., Sakamoto, T., Zhang, B., et al., (poster) ``Statistical Properties of
Gamma-Ray Burst Polarization'', `Huntsville Gamma-Ray Burst Symposium 2008',
Huntsville, USA, Oct 2008
33. Toma, K. (invited talk), ``Statistical Properties of Gamma-Ray Burst Polarization'',
`2008 Nanjing GRB Conference', Nanjing, China, June 2008
34. Toma, K. (oral), ``Gamma-Ray Burst Polarization'', `Accelerators in the Universe',
Tsukuba, KEK, Mar 2008
35. Toma, K., Ioka, K., Nakamura, T. (poster) ``Probing the Efficiency of Electron

Acceleration in Collisionless Shocks through the Radio Polarimetry of Gamma-Ray Burst Afterglows", `Gamma-Ray Bursts 2007', Santa Fe, USA, Nov 2007

36. Toma, K., Ioka, K., Sakamoto, T., Nakamura, T. (poster) ``Low-Luminosity GRB 060218: A Collapsar Jet from a Neutron Star?", `070228: The Next Decade of GRB Afterglows', Amsterdam, Netherlands, Mar 2007
37. Toma, K., Ioka, K., Sakamoto, T., Nakamura, T. (oral) ``Low-Luminosity GRB 060218: A Collapsar Jet from a Neutron Star?", `The 16th Workshop on General Relativity and Gravitation', Niigata, Nov 2006
38. Toma, K., Ioka, K., Yamazaki, R., Nakamura, T. (poster) ``Shallow Decay of Early X-Ray Afterglows from Inhomogeneous Gamma-Ray Burst Jets", `Gamma-Ray Bursts in the Swift Era', Washington DC, USA, Nov 2005
39. Toma, K., Yamazaki, R., Nakamura, T. (oral) ``A Unified Model for Gamma-Ray Bursts", `Ultra-Relativistic Jets in Astrophysics 2005', Banff, Canada, July 2005
40. Toma, K., Yamazaki, R., Nakamura, T. (oral) ``A Possible Origin of Bimodal Distribution of Gamma-Ray Bursts", `The 14th Workshop on General Relativity and Gravitation', Kyoto, Nov 2004
41. Toma, K., Yamazaki, R., Nakamura, T. (poster) ``A Possible Origin of Bimodal Distribution of Gamma-Ray Bursts", `Gamma-Ray Bursts in the Afterglow Era, 4th Workshop', Italy, Oct 2004