

Md Arif Shaikh

Assistant Professor

Gravitational wave astrophysicist working on various aspects of gravitational wave physics, including waveform modeling, data analysis, and tests of general relativity using gravitational wave observations.

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Positions

Assistant Professor	November 2023 – Present
Department of Physics, <i>Vivekananda Satavarshiki Mahavidyalaya</i> Manikpara, West Bengal, 721513, India	
Postdoctoral Fellow	July 2022 – November 2023
Department of Physics and Astronomy, Seoul National University 1 Gwanak-ro, Gwanak-gu, Seoul 08826, Korea Advisor: Hyung Mok Lee	
Postdoctoral Fellow	July 2019 – June 2022
Astrophysical Relativity, International Centre for Theoretical Sciences Hesaraghatta Hobli, Karnataka, 560089, India Advisor: Parameswaran Ajith	

Education

Doctor of Philosophy (PhD)	July 2014 – June 2019
Harish-Chandra Research Institute Chhatnag Road, Jhunsi, Prayagraj, 211019, Uttar Pradesh, India Cosmology & High Energy Astrophysics Advisor: Tapas Kumar Das (tapas@hri.res.in)	
Master of Science (MSc)	July 2012 – June 2014
Harish-Chandra Research Institute Chhatnag Road, Jhunsi, Prayagraj, 211019, Uttar Pradesh, India Cosmology & High Energy Astrophysics Advisor: Tapas Kumar Das (tapas@hri.res.in)	
Bachelor of Science (BSc)	July 2009 – June 2012
Jadavpur University 188, Raja S.C. Mallick Rd, Kolkata 700032, India Faculty of Physics	

Publications

Short author publications

19. Nee, P. J., Ravichandran, A., Field, S. E., Islam, T., Pfeiffer, H. P., Varma, V., Boyle, M., Ceja, A., Ghadiri, N., Kidder, L. E., Kumar, P., Maurya, A., Morales, M., Ramos-Buades, A., Ravishankar, A., Rink, K., Rüter, H. R., Scheel, M. A., [Shaikh, M. A.](#), Tellez, D. “Eccentric binary black holes: A new framework for numerical relativity waveform surrogates.”, 2025, [arXiv:2510.00106](https://arxiv.org/abs/2510.00106)
18. Tiwari, A., Bhat, S. A., [Shaikh, M. A.](#), Kapadia, S. J. “Testing the nature of GW200105 by probing the frequency evolution of eccentricity.” *Astrophys. J.*, 995, 1, 2025, [arXiv:2509.26152](https://arxiv.org/abs/2509.26152)
17. Bhat, S. A., Tiwari, A., [Shaikh, M. A.](#), Kapadia, S. J. “Eccentricity evolution consistency test to distinguish eccentric gravitational-wave signals from eccentricity mimickers.” *Phys. Rev. D*

, 112, 12, 2025, arXiv:2508.14850

16. Shaikh, M. A., Varma, V., Ramos-Buades, A., Pfeiffer, H. P., Boyle, M., Kidder, L. E., Scheel, M. A. "Defining eccentricity for spin-precessing binaries." *Class. Quant. Grav.* , 42, 2025, arXiv:2507.08345
15. Chartier, N., Shaikh, M. A., Lee, H. M., Kim, J. "Comparison between best-fit eccentricity definitions and the standardized definition of eccentricity." *Phys. Rev. D* , 112, 2, 2025, arXiv:2503.19538
14. Deka, U., Prabhu, G., Shaikh, M. A., Kapadia, S. J., Varma, V., Field, S. E. "Surrogate modeling of gravitational waves microlensed by spherically symmetric potentials." *Phys. Rev. D* , 111, 10, 2025, arXiv:2501.02974
13. Deka, U., Chakraborty, S., Kapadia, S. J., Shaikh, M. A., Ajith, P. "Probing the charge of compact objects with gravitational microlensing of gravitational waves." *Phys. Rev. D* , 111, 6, 2025, arXiv:2401.06553
12. Shaikh, M. A., Bhat, S. A., Kapadia, S. J. "A study of the inspiral-merger-ringdown consistency test with gravitational-wave signals from compact binaries in eccentric orbits." *Phys. Rev. D* , 110, 2, 2024, arXiv:2402.15110
11. Shaikh, M. A., Varma, V., Pfeiffer, H. P., Ramos-Buades, A., van de Meent, M. "Defining eccentricity for gravitational wave astronomy." *Phys. Rev. D* , 108, 10, 2023, arXiv:2302.11257
10. Singh, M. K., Divyajyoti, D., Kapadia, S. J., Shaikh, M. A., Ajith, P. "Improved early-warning estimates of luminosity distance and orbital inclination of compact binary mergers using higher modes of gravitational radiation." *Mon. Not. Roy. Astron. Soc.* , 513, 3, 2022, arXiv:2202.05802
9. Maity, S., Shaikh, M. A., Tarafdar, P., Das, T. K. "Carter-Penrose diagrams for emergent space-time in axisymmetrically accreting black hole systems." *Phys. Rev. D* , 106, 4, 2022, arXiv:2106.07598
8. Wei, W., Huerta, E. A., Yun, M., Loutrel, N., Shaikh, M. A., Kumar, P., Haas, R., Kindratenko, V. "Deep Learning with Quantized Neural Networks for Gravitational-wave Forecasting of Eccentric Compact Binary Coalescence." *Astrophys. J.* , 919, 2, 2021, arXiv:2012.03963
7. Singh, M. K., Kapadia, S. J., Shaikh, M. A., Chatterjee, D., Ajith, P. "Improved early warning of compact binary mergers using higher modes of gravitational radiation: A population study." *Mon. Not. Roy. Astron. Soc.* , 502, 2, 2021, arXiv:2010.12407
6. Kapadia, S. J., Singh, M. K., Shaikh, M. A., Chatterjee, D., Ajith, P. "Of Harbingers and Higher Modes: Improved gravitational-wave early-warning of compact binary mergers." *Astrophys. J. Lett.* , 898, 2, 2020, arXiv:2005.08830
5. Shaikh, M. A., Maity, S., Nag, S., Das, T. K. "Effective sound speed in relativistic accretion discs around Schwarzschild black holes." *New Astron.* , 69, 2019, arXiv:1806.04084
4. Shaikh, M. A., Das, T. K. "Linear perturbations of low angular momentum accretion flow in the Kerr metric and the corresponding emergent gravity phenomena." *Phys. Rev. D* , 98, 12, 2018, arXiv:1803.09896
3. Shaikh, M. A.. "Relativistic sonic geometry for isothermal accretion in the Kerr metric." *Class. Quant. Grav.* , 35, 5, 2018, arXiv:1705.04918
2. Datta, S., Shaikh, M. A., Das, T. K. "Acoustic geometry obtained through the perturbation of the Bernoulli's constant." *New Astron.* , 63, 2018, arXiv:1612.07954
1. Shaikh, M. A., Firdousi, I., Das, T. K. "Relativistic sonic geometry for isothermal accretion in the Schwarzschild metric." *Class. Quant. Grav.* , 34, 15, 2017, arXiv:1612.07963

SXS Collaboration

1. Scheel, M. A., others. "The SXS Collaboration's third catalog of binary black hole simulations.", 2025, [arXiv:2505.13378](https://arxiv.org/abs/2505.13378)

LVK Collaboration

34. Abac, A. G., others. "Directional Search for Persistent Gravitational Waves: Results from the First Part of LIGO-Virgo-KAGRA's Fourth Observing Run.", 2025, [arXiv:2510.17487](https://arxiv.org/abs/2510.17487)
33. Abac, A. G., others. "Directed searches for gravitational waves from ultralight vector boson clouds around merger remnant and galactic black holes during the first part of the fourth LIGO-Virgo-KAGRA observing run.", 2025, [arXiv:2509.07352](https://arxiv.org/abs/2509.07352)
32. Abac, A. G., others. "GW250114: Testing Hawking's Area Law and the Kerr Nature of Black Holes." *Phys. Rev. Lett.*, 135, 11, 2025, [arXiv:2509.08054](https://arxiv.org/abs/2509.08054)
31. Abac, A. G., others. "GWTC-4.0: Constraints on the Cosmic Expansion Rate and Modified Gravitational-wave Propagation.", 2025, [arXiv:2509.04348](https://arxiv.org/abs/2509.04348)
30. Abac, A. G., others. "Upper Limits on the Isotropic Gravitational-Wave Background from the first part of LIGO, Virgo, and KAGRA's fourth Observing Run.", 2025, [arXiv:2508.20721](https://arxiv.org/abs/2508.20721)
29. Abac, A. G., others. "Open Data from LIGO, Virgo, and KAGRA through the First Part of the Fourth Observing Run.", 2025, [arXiv:2508.18079](https://arxiv.org/abs/2508.18079)
28. Abac, A. G., others. "GWTC-4.0: Updating the Gravitational-Wave Transient Catalog with Observations from the First Part of the Fourth LIGO-Virgo-KAGRA Observing Run.", 2025, [arXiv:2508.18082](https://arxiv.org/abs/2508.18082)
27. Abac, A. G., others. "GWTC-4.0: Population Properties of Merging Compact Binaries.", 2025, [arXiv:2508.18083](https://arxiv.org/abs/2508.18083)
26. Abac, A. G., others. "GWTC-4.0: Methods for Identifying and Characterizing Gravitational-wave Transients.", 2025, [arXiv:2508.18081](https://arxiv.org/abs/2508.18081)
25. Abac, A. G., others. "GWTC-4.0: An Introduction to Version 4.0 of the Gravitational-Wave Transient Catalog.", 2025, [arXiv:2508.18080](https://arxiv.org/abs/2508.18080)
24. Abac, A. G., others. "All-sky search for long-duration gravitational-wave transients in the first part of the fourth LIGO-Virgo-KAGRA Observing run.", 2025, [arXiv:2507.12282](https://arxiv.org/abs/2507.12282)
23. Abac, A. G., others. "All-sky search for short gravitational-wave bursts in the first part of the fourth LIGO-Virgo-KAGRA observing run.", 2025, [arXiv:2507.12374](https://arxiv.org/abs/2507.12374)
22. Abac, A. G., others. "GW231123: a Binary Black Hole Merger with Total Mass $190\text{--}265 M_\odot$.", 2025, [arXiv:2507.08219](https://arxiv.org/abs/2507.08219)
21. Abac, A. G., others. "Search for Continuous Gravitational Waves from Known Pulsars in the First Part of the Fourth LIGO-Virgo-KAGRA Observing Run." *Astrophys. J.*, 983, 2, 2025, [arXiv:2501.01495](https://arxiv.org/abs/2501.01495)
20. Abac, A. G., others. "Search for Gravitational Waves Emitted from SN 2023ixf." *Astrophys. J.*, 985, 2, 2025, [arXiv:2410.16565](https://arxiv.org/abs/2410.16565)
19. Abac, A. G., others. "A Search Using GEO600 for Gravitational Waves Coincident with Fast Radio Bursts from SGR 1935+2154." *Astrophys. J.*, 977, 2, 2024, [arXiv:2410.09151](https://arxiv.org/abs/2410.09151)
18. Raman, G., others. "Swift-BAT GUANO Follow-up of Gravitational-wave Triggers in the Third LIGO-Virgo-KAGRA Observing Run." *Astrophys. J.*, 980, 2, 2025, [arXiv:2407.12867](https://arxiv.org/abs/2407.12867)
17. Abac, A. G., others. "Observation of Gravitational Waves from the Coalescence of a 2.5-4.5 M_\odot Compact Object and a Neutron Star." *Astrophys. J. Lett.*, 970, 2, 2024, [arXiv:2404.04248](https://arxiv.org/abs/2404.04248)
16. Abac, A. G., others. "Ultralight vector dark matter search using data from the KAGRA O3GK run." *Phys. Rev. D*, 110, 4, 2024, [arXiv:2403.03004](https://arxiv.org/abs/2403.03004)

15. Fletcher, C., others. "A Joint Fermi-GBM and Swift-BAT Analysis of Gravitational-wave Candidates from the Third Gravitational-wave Observing Run." *Astrophys. J.*, 964, 2, 2024, [arXiv:2308.13666](#)
14. Abac, A. G., others. "Search for Eccentric Black Hole Coalescences during the Third Observing Run of LIGO and Virgo." *Astrophys. J.*, 973, 2, 2024, [arXiv:2308.03822](#)
13. Abbott, R., others. "Search for Gravitational-lensing Signatures in the Full Third Observing Run of the LIGO-Virgo Network." *Astrophys. J.*, 970, 2, 2024, [arXiv:2304.08393](#)
12. Abbott, R., others. "Open Data from the Third Observing Run of LIGO, Virgo, KAGRA, and GEO." *Astrophys. J. Suppl.*, 267, 2, 2023, [arXiv:2302.03676](#)
11. Abbott, R., others. "Search for subsolar-mass black hole binaries in the second part of Advanced LIGO's and Advanced Virgo's third observing run." *Mon. Not. Roy. Astron. Soc.*, 524, 4, 2023, [arXiv:2212.01477](#)
10. Abbott, R., others. "Search for Gravitational-wave Transients Associated with Magnetar Bursts in Advanced LIGO and Advanced Virgo Data from the Third Observing Run." *Astrophys. J.*, 966, 1, 2024, [arXiv:2210.10931](#)
9. Abbott, R., others. "Model-based Cross-correlation Search for Gravitational Waves from the Low-mass X-Ray Binary Scorpius X-1 in LIGO O3 Data." *Astrophys. J. Lett.*, 941, 2, 2022, [arXiv:2209.02863](#)
8. Abbott, R., others. "Search for continuous gravitational wave emission from the Milky Way center in O3 LIGO-Virgo data." *Phys. Rev. D*, 106, 4, 2022, [arXiv:2204.04523](#)
7. Abbott, R., others. "First joint observation by the underground gravitational-wave detector KAGRA with GEO 600." *PTEP*, 2022, 6, 2022, [arXiv:2203.01270](#)
6. Abbott, R., others. "Search for gravitational waves from Scorpius X-1 with a hidden Markov model in O3 LIGO data." *Phys. Rev. D*, 106, 6, 2022, [arXiv:2201.10104](#)
5. Abbott, R., others. "All-sky search for continuous gravitational waves from isolated neutron stars using Advanced LIGO and Advanced Virgo O3 data." *Phys. Rev. D*, 106, 10, 2022, [arXiv:2201.00697](#)
4. Abbott, R., others. "Tests of General Relativity with GWTC-3." 2021, [arXiv:2112.06861](#)
3. Abbott, R., others. "All-sky search for gravitational wave emission from scalar boson clouds around spinning black holes in LIGO O3 data." *Phys. Rev. D*, 105, 10, 2022, [arXiv:2111.15507](#)
2. Abbott, R., others. "Searches for Gravitational Waves from Known Pulsars at Two Harmonics in the Second and Third LIGO-Virgo Observing Runs." *Astrophys. J.*, 935, 1, 2022, [arXiv:2111.13106](#)
1. Abbott, R., others. "Constraints on the Cosmic Expansion History from GWTC-3." *Astrophys. J.*, 949, 2, 2023, [arXiv:2111.03604](#)

Research Visits

20. [Chunglee Kim](#), [Ewha Womans University](#), Seoul, Korea, October 20–21, 2025
19. Hyung Mok Lee, [Seoul National University](#), Seoul, Korea, October 15–25, 2025
18. [Prayush Kumar](#), [ICTS-TIFR](#), Bangalore, India, August 4–10, 2025
17. [Shasvath Kapadia](#), [IUCAA](#), Pune, India, June 16–22, 2025
16. Hyung Mok Lee, [Seoul National University](#), Seoul, Korea, October 10–20, 2024
15. Hyung Won Lee, [Inje University](#), Gimhae, Korea, November 2–3, 2023
14. [Shasvath Kapadia](#), [IUCAA](#), Pune, India, June 18–21, 2023

13. [Prayush Kumar](#), [ICTS-TIFR](#), Bangalore, India, June 15–18, 2023
12. Zhoujian Cao, [BNU](#), Beijing, China, May 9–11, 2023
11. [Arman Shafieloo](#), [KASI](#), Daejeon, Korea, April 19–20, 2023
10. Young Bok Bae, [IBS](#), Daejeon, Korea, April 18–19, 2023
9. [Junichi Yokoyama](#), [UoT](#), Tokyo, Japan, November 17–19, 2022
8. [Hisa-aki Shinkai](#), [OIT](#), Osaka, Japan, November 15–17, 2022
7. [Kunihiro Ioka](#), [YITP](#), Kyoto, Japan, November 13–15, 2022
6. [Frank Ohme](#), [AEI](#), Hannover, Germany, April 20–24, 2022
5. [Harald Pfeiffer](#), [AEI](#), Potsdam, Germany, March 20–April 20, 2022
4. [Tapas Kumar Das](#), [HRI](#), Allahabad, India, November 15–25, 2019
3. [P Ajith](#), [ICTS-TIFR](#), Bangalore, India, March 25–April 6, 2019
2. [P Ajith](#), [ICTS-TIFR](#), Bangalore, India, September 27–October 11, 2017
1. Tarun Souradeep, [IUCAA](#), Pune, India, September 6–October 20, 2014

Seminars

14. “[Defining eccentricity for spin-precessing binaries](#)”, [ICTS](#), Bangalore, India, August 7, 2025
13. “[Defining eccentricity for spin-precessing binaries](#)”, [IUCAA](#), Pune, India, June 18, 2025
12. “[gw_eccentricity: a Python package to measure orbital eccentricity from gravitational waveforms](#)”, [Inje University](#), Gimhae, Korea, November 3, 2023
11. “[gw_eccentricity: a Python package to measure orbital eccentricity from gravitational waveforms](#)”, [IUCAA](#), Pune, India, June 19, 2023
10. “[gw_eccentricity: a Python package to measure orbital eccentricity from gravitational waveforms](#)”, [ICTS-TIFR](#), Bangalore, India, June 15, 2023
9. “[Measuring Eccentricity from Gravitational Waveform](#)”, [ITP](#), Beijing, China, May 11, 2023
8. “[Measuring Eccentricity from Gravitational Waveform](#)”, [BNU](#), Beijing, China, May 10, 2023
7. “[Defining eccentricity for gravitational wave astronomy](#)”, [KASI](#), Daejeon, Korea, April 20, 2023
6. “[Standardizing the definition of eccentricity for gravitational wave astronomy](#)”, [IBS](#), Daejeon, Korea, April 18, 2023
5. “[Defining eccentricity for gravitational wave astronomy](#)”, [ICTS-TIFR](#), Bangalore (online), India, December 1, 2022
4. “[Defining eccentricity for gravitational wave astronomy](#)”, [RESCEU](#), Tokyo, Japan, November 18, 2022
3. “[Defining eccentricity for gravitational wave astronomy](#)”, [OIT](#), Osaka, Japan, November 16, 2022
2. “[Defining eccentricity for gravitational wave astronomy](#)”, [YITP](#), Kyoto, Japan, November 14, 2022
1. “[On the emergent sonic geometry through the linear perturbation of relativistic black hole accretion](#)”, [HRI](#), Allahabad, India, November 18, 2019

Workshops

25. “[The Future of Gravitational-Wave Astronomy](#)”, [ICTS](#), Bangalore, India, October 27–31, 2025

24. "Cosmology in Multi-Messenger Era", [Gravitational Wave Universe](#), SNU , Seoul, Korea, October 14–14, 2024
23. "[KAS 2023 Fall Meeting](#)", Korean Astronomical Society , RABADA PLAZA, JEJU, Korea, October 18–20, 2023
22. "[LVK 2023 September Meeting](#)", LVK Collaboration, Toyama, Japan, September 11–15, 2023
21. "GW Universe Workshop 7", [Gravitational Wave Universe](#) , Seoul, Korea, June 12–12, 2023
20. "[KAS 2023 Spring Meeting](#)", Korean Astronomical Society , LAHANHOTEL, JEONJU, Korea, April 12–14, 2023
19. "[LVK 2023 March Meeting](#)", Center for Interdisciplinary Exploration and Research in Astrophysics (CIERA) , (remote participation), Evanston, USA, March 13–16, 2023
18. "[68th Workshop on Gravitational Waves and Numerical Relativity](#)", APCTP , Pohang, Korea, March 15–16, 2023
17. "GW Universe Winter Workshop 2023", [Gravitational Wave Universe](#) , Yongpyong Ski Resort, Gwangwon, Korea, February 26–March 1, 2023
16. "[GW Universe Workshop6](#)", [Gravitational Wave Universe](#) , Seoul, Korea, November 24–25, 2022
15. "[67th Workshop on Gravitational Waves and Numerical Relativity](#)", APCTP , Pohang, Korea, October 26–27, 2022
14. "[Summer School on Gravitational-Wave Astronomy](#)", ICTS-TIFR , Bangalore, India, July 5–16, 2021
13. "[ICERM Fall 2020 Workshop 1: Advances and Challenges in Computational Relativity](#)", ICERM, Brown University , Online, USA, September 14–18, 2020
12. "[ICTS workshop on parameter estimation with bilby](#)", ICTS-TIFR , Bangalore, India, August 27–28, 2020
11. "[Test of General Relativity using Gravitational Waves](#)", IACS, Kolkata \{}& IIT Gandhinagar , Online, India, August 13–14, 2020
10. "[PyCBC Inference Online Workshop 2020](#)", AEI, Hannover , Online, Germany, June 25–26, 2020
9. "[Gravitational-Wave Open Data Workshop #3](#)", LIGO-Virgo Collaboration, Online, USA, May 26–28, 2020
8. "[Summer School on Gravitational-Wave Astronomy](#)", ICTS-TIFR , Online, India, May 18–23, 2020
7. "[Astrophysics of Supermassive Black Holes](#)", ICTS-TIFR , Bangalore, India, December 17–19, 2019
6. "[Newton Bhabha-Open Data workshop](#)", IUCAA , Pune, India, December 4–6, 2019
5. "[The Future of Gravitational-Wave Astronomy](#)", ICTS , Bangalore, India, August 19–22, 2019
4. "[Summer School on Gravitational-Wave Astronomy](#)", ICTS-TIFR , Bangalore, India, July 25–26, 2019
3. "[Theoretical Aspects of Astroparticle Physics, Cosmology and Gravitation](#)", Galileo Galilei Institute for Theoretical Physics , Florence, Italy, March 11–22, 2019
2. "[Black Holes: From Classical to Quantum Gravity](#)", IIT , Gandhinagar, India, December 15–19, 2017
1. "[Summer School on Gravitational-Wave Astronomy](#)", ICTS-TIFR , Bangalore, India, July 17–28, 2017

Conference Talks

9. "What do we know about the eccentricity of the GW sources?", Cosmology in Multi-Messenger Era, Seoul, Korea, October 14–14, 2024
8. "A study of IMRCT on eccentric GW signal", GW Universe Workshop 8, Seoul, Korea, December 26–27, 2023
7. "Comparing eccentric waveforms for gravitational wave data analysis", [2nd H.S. Yun Astronomy Workshop](#), Seoul, Korea, August 29–30, 2023
6. "Defining eccentricity for gravitational wave astronomy", [ICGAC15](#), Gyeongju, Korea, July 3–7, 2023
5. "Defining eccentricity for gravitational wave astronomy", [APSWGC](#), Hangzhou, China, May 14–22, 2023
4. "Defining eccentricity for gravitational wave astronomy", [GWPAW](#), Melbourne, Australia, December 4–9, 2022
3. "Probing the evolution history of compact binaries from higher modes of gravitation waves", [ICTS In-house symposium](#), Bangalore, India, February 17–18, 2020
2. "Relativistic acoustic geometry in general relativistic accretion disc around Kerr black holes", [Exploring the Universe: Near Earth Space Science to Extra-Galactic Astronomy](#), Kolkata, India, November 14–17, 2018
1. "Emergence of curved sonic manifold for isothermal accretion in black hole metric", [Young Astronomers Meet](#), Pune, India, September 11–15, 2017

Conference Posters

5. "Surrogate and hybrid models of eccentric waveforms using numerical relativity", [765. WE-Heraeus-Seminar: Gravitational Wave and Multimessenger Astronomy](#), Physikzentrum Bad Honnef, Germany, April 25–28, 2022
4. "Probing the evolution of compact binaries using higher modes of gravitational waves", 39th meeting of ASI, Online, India, February 18–23, 2021
3. "Probing evolution history of compact binaries using higher modes of gravitational waves", LVK September Meeting, Online, LIGO, September 14–17, 2020
2. "Relativistic sonic geometry for isothermal accretion in Kerr metric", 29th meeting of IAGRG, Guwahati, India, May 18–20, 2017
1. "Emergence of relativistic sonic geometry through perturbation of matter in black hole metric", 35th meeting of ASI, Jaipur, India, March 6–10, 2017

References

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