Koushik Sen **Professional website - ORCiD ID - Facebook**

CONTACT INFORMATION
Steward Observatory, 933 N Cherry Ave, Tucson, AZ 85719 +1 520 738 2300
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RESEARCH INTERESTS
Massive binary and stellar evolution: stellar winds, internal mixing processes, tides, X-ray binaries, stripped-envelope supernovae, gravitational wave progenitors

EMPLOYMENT

University of Arizona, Tucson, USA Jan 2025 - present

Research associate, Department of Astronomy, Steward Observatory

Nicolaus Copernicus University in Torun, Poland Nov 2022 - Dec 2024

Research adjunct, Faculty of Physics, Astronomy and Informatics

EDUCATION

Argelander Institute for Astronomy, Bonn, Germany

Ph.D. in Natural Sciences, Astronomy and Astrophysics, September 27 2022

- Grade: 1.3/4.0 (1.0 - highest, 4.0 - lowest, in steps of 0.3)
- Thesis: *Evolution of short-period massive binaries in the Magellanic Clouds*
- Advisor: Prof. Dr. Norbert Langer

Indian Institute of Technology, Kharagpur, West Bengal, India

Integrated Bachelors and Masters in Science, Physics, July 2018

- GPA: 9.65/10, Institute Silver Medalist
- Masters thesis: *Modelling and evolution of supernova remnants*
- Advisor: Prof. Somnath Bharadwaj

Sri Aurobindo Institute of Education, Kolkata, India

High School, I.S.C., Mathematics, Physics, Chemistry and English, June 2013

- Percentage marks: 95.25%
- IIT JEE: All India Rank: 4958.

STANDARD TESTS

- **GRE** *General*: Score - 332/340; *Physics*: Score - 980/990; Dec 2017

RESEARCH EXPERIENCE - UNDERGRADUATE

Topic: **Laser transmission through fibre at low wavelength (UV) range**
Laser Spectroscopy Group, May 2018 to July 2018
Max Planck Institute for Quantum Optics, Garching, Germany
Supervisor: Prof Dr Thomas Udem; in the group of Prof Dr T. W. Haensch

Topic: **Short-term variability in magnetized massive stars: contribution from unstable magnetosonic waves.**
Astronomy and Astrophysics Division, May 2017 to July 2017
University of Alberta, Edmonton, Canada
Supervisor: Rodrigo Fernandez, Associate Professor

Topic: **The cooling zones of shocks in the winds of massive stars.**
Astronomy and Astrophysics Division, May 2016 to July 2016
University Observatory Munich, Ludwig Maximilian University, Munich, Germany
Supervisor: Joachim Puls, Professor

Topic: **Encoding information in the phases of qubits.**
Physical Sciences Division, December 2014, May 2015 to July 2015
Indian Institute of Science, Education and Research, Kolkata, Kalyani, India
Supervisor: Prof Dr Prasanta K. Panigrahi, Professor

Topic: **Chaotic Oscillations of a current carrying coil in a magnetic field.**
Plasma Physics Division, May 2014 to July 2014
Saha Institute of Nuclear Physics, Kolkata, India
Supervisor: A. N. Sekar Iyengar, Emeritus Professor

Awards

Travel Grants - International

- IAU Travel Grant - IAU General Assembly, Cape Town, SA 2024
- AG Travel Grant - German Astronomical Society, Germany 2022
- APS Distinguished Student (DS) Program 2018
- University of Alberta Research Experience (UARE) Scholarship, Canada 2017
- DAAD WISE Scholarship, Germany 2016

Graduation - IIT Kharagpur 2018

- Institute Silver Medal, H.N. Bose Memorial Award, G.B. Mitra Award
- Nilanjan Ganguly Memorial Award, Kedarnath Singh Memorial Award

Undergraduate National Fellowships - India

- National Initiative on Undergraduate Sciences (NIUS) Fellow 2013-2014
- Inspire Fellow, Dept. of Science and Technology, India 2013-2018

Referee/ Reviewer

Telescopes

- Hubble Space Telescope (HST) - Cycle 33 Stellar Physics Panellist
- ESO Very Large Telescope (VLT) - P114 Distributed Peer Reviewer

Journals

- The Astrophysical Journal (ApJ) - Refereed 1 article
- Astronomy and Astrophysics (A&A) - Refereed 2 articles

Competitive telescope time received

NASA, Hubble Space Telescope

- **(PI)** MAMA E140M, Prop. Nr. 18115, Cycle 33, total orbits: 6 2025

European Space Agency (ESA), XMM-Newton

- **(PI)** EPIC pn, Prop. Nr. 096343, AO24, total observing time: 54 ks 2025

European Southern Observatory (ESO), Very Large Telescope (VLT)

- FEROS, Prog ID: 114.27SV, P114, total observing time: 92 hrs (co-I) 2025
- **(PI)** UVES, Prog ID: 114.27G8, P114, total observing time: 10 hrs 2024
- FEROS, Prog ID: 113.26Y5, P113, total observing time: 76 hrs (co-I) 2024
- FLAMES, Prog ID: 112.25R7, P112, total observing time: 117 hrs (co-I) 2023

Scientific collaborations

- Stable Mass Transfer Enthusiasts. Flatiron Institute, CCA 2025-present
- The BLOeM survey. PI: Tomer Shenar, Julia Bodensteiner 2024-present

Workshops

- Stellar-Mass Black Holes at the Nexus of Optical, X-ray, and Gravitational Wave Surveys, KITP, UCSB, USA **Oct 26-Nov 22 2025**
- Stable Mass Transfer 2.0 Workshop, Flatiron Institute, USA May 27-30, 2025

Presentations

Invited reviews

- Binary Stars in the Space Era, Keele, UK - "Binary interactions." July 2, 2025

Invited seminars - slides here

- Astronomical Observatory of the Jagiellonian University, Krakow - "The renaissance of Algol binaries" weekly seminar - April 12, 2024
- Inter-University Centre for Astronomy and Astrophysics - "Massive Algols as whetstones for binary star evolution towards GW sources." Weekly seminar of the Institute - October 26, 2023
- Tata Institute for Fundamental Research - "Observable properties of massive interacting binaries on the main sequence." Weekly seminar of the Department of Astronomy and Astrophysics - October 10, 2023
- Indian Institute of Technology, Kharagpur - "Observable properties of massive Algol binaries." Department of Physics - October 3, 2023
- Jageillonian University, Kraków - "Evolution of short-period massive binary stars in the Magellanic Clouds." Astrophysics seminar of the Faculty of Physics, Astronomy and Applied Computer Science - April 5, 2023

- Institute of Astronomy, Nicolaus Copernicus University, Torún - "Evolution of short-period massive binary stars in the Magellanic Clouds." Seminar of the Faculty of Physics, Astronomy and Informatics - October 10, 2022

Contributed talks - slides & some videos recordings here

- EAS 2025, Session SS37 - Cork, Ireland - "X-ray emission from stripped helium star+black hole binaries." June 25, 2025
- EAS 2025, Session S5 - Cork, Ireland - "Empirical constraints on mass transfer physics from massive Algol binaries." June 26, 2025
- IAU Symposium 398, MODEST 25 - Seoul, South Korea - "X-ray emission from helium star+black hole binaries." June 19, 2025
- e-Rosita Meeting: from stars to Cosmology - Garching, MPE, MPG - "Whispering in the dark: X-ray faint BHs around OB stars." Sept 20, 2024
- VFTS Meeting - Madrid, ESA, Spain - "Faint X-ray emission from black holes with OB star companions." Sept 16, 2024
- Galactic and extragalactic X-ray transients, theory and observational perspectives - Warsaw, Poland - "X-ray faint BHs around OB stars." Sept 11, 2024
- MODEST 24 - Warsaw, Poland - "Whispering in the dark: X-ray faint BHs around OB stars." Aug 22, 2024
- IAU General Assembly - Div G: Stars and Stellar Physics - Cape Town - "Observable properties of massive Algols." Aug 12, 2024
- IAU 389 — Gravitational Wave Astrophysics - Cape Town - "Massive Algols as whetstones for the progenitors gravitational wave sources." Aug 6, 2024
- LIAC41: The eventful life of massive star multiples - Liege - "Observable properties of Algol binaries across the Hertzsprung-Russell diagram." July 16, 2024
- 3,2,1: Massive Triples, Binaries and Mergers - KU Leuven - "Observable consequences of interactions in massive main sequence binaries." July 18, 2023
- EAS Annual meeting - Krakow - "Reverse Algols and hydrogen-rich Wolf-Rayet stars from massive binary evolution." July 11, 2023
- The Wolf-Rayet phenomenon in the Universe - Mexico - "Hydrogen-rich Wolf-Rayet stars on the main sequence from massive binaries." June 19, 2023
- AG 2022: "Nuclear-timescale reverse Algol evolution and hydrogen-rich Wolf-Rayet stars from very massive binaries." September 15, 2022
- SuperVirtual-2021 - From Common to Exotic Transients - "Compact object progenitors and their companions on the HR diagram." November 15, 2021
- MPA-NBIA Gravitational Wave Astrophysics Workshop, Garching - "Detailed models of interacting short-period massive binary stars as progenitors of gravitational wave sources." November 9, 2021
- AG 2021: "X-ray emission from BH + O star binaries expected to descend from the observed galactic WR + O binaries." September 15, 2021
- AG 2020: "Case A mass transfer: A comprehensive study of their observable stellar properties." September 24, 2020
- APS April Meeting - "From Quarks to Cosmos": "Variability in winds of magnetic massive stars: effect of unstable magnetosonic modes." April 15, 2018

Outreach talks - slides & some videos recordings here

- Space Drafts, AOT Tucson - "Batman and eclipsing binaries." May 20, 2025

Teaching Experience

1. **Guest Lecturer**, Graduate astronomy program at the University of Arizona
   - Massive binary star evolution Current semester 2025
     Instructor: Mathieu Renzo, University of Arizona
2. **Guest Lecturer**, Masters course at the Nicolaus Copernicus University
   - Introduction to binary stars Summer semester 2024
     Instructor: Dorottya Szecsi, Nicolaus Copernicus University in Torun
3. **Tutor**, Masters courses at the University of Bonn
   - Stellar Nucleosynthesis Summer semester 2021
     Instructor: Norbert Langer, Argelander Institute for Astronomy
   - Stellar Structure and Evolution Winter semester 2020
     Instructor: Norbert Langer, Argelander Institute for Astronomy
   - Programming in Python Summer semester 2020

Instructor: Thomas Erben, Argelander Institute for Astronomy

Publications

ADS links: First-authored publications here **and** all publications here

First-authored publications

1. Sen, K., A. Olejak, & S. Banerjee (2025), A&A, 696, A54
2. Sen, K., I. El Mellah, N. Langer, et al. (2024), A&A, 690, A256
3. Sen, K., N. Langer, D. Pauli, et al. (2023), A&A, 672, A198
4. Sen, K., N. Langer, P. Marchant, et al. (2022), A&A, 659, A98
5. Sen, K., X.-T. Xu, N. Langer, et al. (2021), A&A, 652, A138
6. Sen, K., R. Fernández, & A. Socrates (2018), MNRAS, 477, 2286

Co-authored publications

1. Sana, H., et al. (2025), NatAs, *accepted*, Manuscript #: NATASTRON-24080805B "A high fraction of close massive binary stars at low metallicity"
2. Villaseñor, J., et al. (2025), arXiv, arXiv:2503.21936
3. Xu, X.-T., et al. (2025), arXiv, arXiv:2503.23876
4. Patrick, L., et al. (2025), arXiv, arXiv:2502.02644
5. Bodensteiner, J., et al. (2025), arXiv, arXiv:2502.02641
6. Britavskiy, N., et al. (2025), arXiv, arXiv:2502.12239
7. Schürmann, C., et al. (2024), A&A, 690, A282
8. Shenar, T., et al. (2024), A&A, 690, A289
9. Menon, A., et al. (2024), arXiv, arXiv:2410.16427
10. Belczynski, K., et al. (2024), A&A, 690, A21
11. Sana, H., et al. (2024), IAUS, 361, 267
12. Banyard, G., et al. (2023), A&A, 674, A60
13. Shenar, T., et al. (2022), A&A, 665, A148
14. Mahy, L., et al. (2022), A&A, 664, A159
15. Shenar, T., et al. (2022), NatAs, 6, 1085
16. Mahy, L., et al. (2021), mobs.conf, 55
17. Menon, A., et al. (2021), MNRAS, 507, 5013
18. Puls, J., et al. (2020), A&A, 642, A172
19. Langer, N., et al. (2020), A&A, 638, A39

References

- **Prof Dr Norbert Langer**, PhD supervisor, Argelander Institute for Astronomy, nlanger@astro.uni-bonn.de
- **Prof Dr Hugues Sana**, collaborator, KU Leuven, hugues.sana@kuleuven.be
- **Prof Dr Dorottya Szecsi**, postdoc supervisor, Nicolaus Copernicus University in Torun, dorottya@umk.pl
- **Prof Dr Mathieu Renzo**, postdoc supervisor, Steward Observatory, University of Arizona, mrenzo@arizona.edu