Sumit K. Sarbadhicary – Curriculum Vitae

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RESEARCH INTERESTS

I am broadly interested in supernovae, their progenitor stars, supernova remnants, and feedback in galaxies. I make heavy use of multi-wavelength data obtained with Hubble, JWST, VLA, ALMA, and IFU spectrographs (e.g. MUSE, SDSSV-LVM).

EMPLOYMENT

Sep 2024 – *Assistant Research Scientist*, Astronomy
Johns Hopkins University

2021 – 2024 *CCAPP Postdoctoral Fellow*, Astronomy
The Ohio State University

2018 – 2021 *Postdoctoral Researcher*, Astronomy
Michigan State University
Supervisor: Laura Chomiuk

EDUCATION

2014-2018 PhD, Astronomy - University of Pittsburgh
Advisor: Carles Badenes (Pitt)
Thesis: *Progenitor Scenarios of Supernovae from Local Group Stellar Populations and Supernova Remnants*

2012-2014 M.S., Astronomy
University of Pittsburgh

2008-2012 B.S., Physics (Astronomy conc.)
Louisiana State University

PUBLICATIONS

Lead-Author

1. **Sarbadhicary, S. K. et al, 2024**, to be submitted to ApJ
   [A first-look at Supernova Remnants in M33 with JWST]
2. **Sarbadhicary, S. K. et al 2023b**, submitted to ApJ, arXiv:2310.17694
   [Where do stars explode in the ISM? – The distribution of dense gas around massive stars and supernova remnants in M33]

3. **Sarbadhicary, S. K. et al 2023a**, MNRAS, 526, 6214
   [On Odd Radio Circles as Supernova Remnants: Possible distances, ages and ambient environmentss]
4. **Sarbadhicary S.K. et al 2022**, ApJ, 928, 54
   [Testing the Momentum-driven Supernova Feedback Paradigm in M31]
5. **Sarbadhicary, S. K. et al 2021**, ApJ, 923, 31
   [CHILES VERDES: Radio variability at an unprecedented depth and cadence in the COSMOS field]
6. **Sarbadhicary S.K. et al 2020**, ApJ, 912, 120
   [The RR Lyrae Delay-Time Distribution: A Novel Perspective on Models of Old Stellar Populations]
7. **Sarbadhicary, S. K. et al 2019**, ApJ, 872, 191S
   [The two most recent thermonuclear supernovae in the Local Group: Radio constraints on the progenitors and evolution]
8. **Sarbadhicary, S. K. et al 2017**, MNRAS, 464, 2326.
   [Supernova Remnants in the Local Group I: A model for the radio luminosity function and visibility times of supernova remnants]

Student-Led

[Papers led by students that I directly advised* or co-advised†]

1. *Showerman, G, *Griffith O., **Sarbadhicary, S. K.** et al, 2024, to be submitted
   [A comprehensive VLA radio survey of Type Ia-CSM supernovae]
2. †Chen, N. M., Leroy, A. K., **Sarbadhicary, S. K.** et al, 2024, ApJ, 168, 5
   [H-alpha emission and HII regions at the locations of recent supernovae in nearby galaxies]
3. *Li, J., Kreckel, K., **Sarbadhicary, S. K.** et al, 2024, accepted to A&A, arXiv:2405.08974
   [Discovery of ∼2400 new supernova remnants in 19 nearby star-forming galaxies with MUSE spectroscopy]
4. †Chen, N. M. et al (incl. **Sarbadhicary, S. K.**) 2023, ApJ, 944, 110
   [Comparing the locations of supernovae to CO (2-1) emission in their host galaxies]
5. †Dong, Y., Milisavljevic, D., Leja, J., **Sarbadhicary, S. K.** et al 2022, 927, 199
   [Physical Properties of the Host galaxies of Ca-rich Transients]

Co-Authored (Major Contributions)

[Papers that I co-wrote with the lead-author, led the observations, imaging, and/or the modeling and interpretation.]

1. Hosseinzadeh G., Sand D., **Sarbadhicary, S. K.** et al 2023, ApJL, 953, 15
   [The Early Light Curve of SN 2023bee: Constraining Type Ia Supernova Progenitors the Apian Way]
2. Nyamai, M. M. et al (incl. **Sarbadhicary, S. K.**) 2022, MNRAS, 523, 1661
   [Synchrotron emission from double-peaked radio light curves of the symbiotic recurrent nova V3890 Sagitarii]
3. Harris, C. E., **Sarbadhicary, S. K.** et al 2023, ApJ, 952, 24
   [Radio Observations of Six Young Type Ia Supernovae]
4. Sand, D., **Sarbadhicary, S. K.** et al 2021, ApJ, 922, 21
   [Circumstellar Medium Constraints on the Environment of Two Nearby Type Ia Supernovae: SN 2017cbv and SN 2020nlb]
5. Burke J., Howell D. A., **Sarbadhicary S. K.** et al 2021, ApJ, 919, 142
   [A Bright Ultraviolet Excess in the Transitional 02es-like Type Ia Supernova 2019yvq]
6. Pellegrino, C., Howell, D. A., **Sarbadhicary, S. K.** et al 2020, ApJ, 897, 159
   [Constraining the Source of the High-velocity Ejecta in Type Ia SN 2019ein]
7. Launey, K. D., **Sarbadhicary, S. K.** et al 2014, Comp. Physics Communications, 185, 284
   [Program in C for studying characteristic properties of two-body interactions in the framework of spectral distribution theory]

Co-Authored (Minor Contributions)

[Papers where I made small but significant contributions to the writing, data-reduction, imaging, and interpretation of science results.]

1. Rodriguez, J. M. et al (incl. **Sarbadhicary, S. K.**) 2024, submitted to ApJ + under-review
   [Tracing the earliest stages of star and cluster formation in nearby galaxies with PHANGS-JWST and HST: compact 3.3 μm PAH emitters and their relation to the optical census of star clusters]
2. Baron, D. et al (incl. **Sarbadhicary, S. K.**) 2024, submitted to ApJ + under-review
   [PHANGS-ML: the universal relation between PAH band and optical line ratios across nearby star-forming galaxies]
3. Whitmore, B. et al (incl. **Sarbadhicary, S. K.**) 2024, submitted to ApJ + under-review
   [Empirical SED Templates for Star Clusters Observed with HST and JWST: No Strong PAH or IR Dust Emission after Five Myr]
4. Pingel, N. M. et al (incl. **Sarbadhicary, S. K.**) 2024, accepted to ApJ
   [The Local Group L-Band Survey: The First Measurements of Localized Cold Neutral Medium Properties in the Low-Metallicity Dwarf Galaxy NGC 6822]
5. Hassani, H. et al (incl. **Sarbadhicary, S. K.**) 2023, ApJ, 221, 2
   The PHANGS-AstroSat Atlas of Nearby Star Forming Galaxies]
6. Pathak D. et al (incl. **Sarbadhicary, S. K.**) 2023, AJ, 167, 39
   [A Two-component Probability Distribution Function Describes the mid-IR Emission from the Disks of Star-forming Galaxies]
7. Peltonen J. et al (incl. **Sarbadhicary, S. K.**) 2023, MNRAS, 527, 10668
   [JWST Reveals Star Formation Across a Spiral Arm in M33]
8. Egorov O. V. et al (incl. **Sarbadhicary, S. K.**) 2023, A&A, 678, 153
   [Quantifying the energy balance between the turbulent ionised gas and young stars]
9. Watkins E. J. et al (incl. **Sarbadhicary, S. K.**) 2023, A&A, 676, 67
   [Quantifying the energetics of molecular superbubbles in PHANGS galaxies]
10. Chen N. M. et al (incl. **Sarbadhicary, S. K.**) 2023, ApJL, 944, 28
    [Serendipitous Nebular-phase JWST Imaging of SN Ia SN 2021aefx: Testing the Confinement of ^{56}Co Decay Energy]
11. Barnes, A. T. et al (incl. **Sarbadhicary, S. K.**) 2022, ApJL, 944, 22
    [PHANGS-JWST First Results: Multi-wavelength view of feedback-driven bubbles (The Phantom Voids) across NGC 628]
12. Cendes, Yvette, Drout, Maria R., Chomiuk, Laura, **Sarbadhicary, S. K.** 2020, ApJ, 894, 39
    [Thirty Years of Radio Observations of Type Ia SN 1972E and SN 1895B: Constraints on Circumstellar Shells]
13. Nyland, K. et al (incl. **Sarbadhicary, S.K.** 2020, ApJ, 905, 74
    [Quasars that have Transitioned from Radio-quiet to Radio-loud on Decadal Timescales Revealed by VLASS and FIRST]

SUCCESSFUL GRANTS/PROPOSALS

Principal Investigator

- **Hubble**
  - AR 17572 (1 yr), $77,169
    [A comprehensive survey of where stars explode in the interstellar medium]
- **VLA**
  - 24B-381 (1 hr)
    [Is SN 2022esa the second radio-detected Type Ia supernova?]
  - 23A-382 (1 hr)
    [VLA observation of the very young nearby Type Ia 2023bee]

- 23A-328 (9.25 hrs)
  [A comprehensive search for late-time radio emission from Type Ia-CSM]
- 19B-346 (1 hr)
  [The first radio observation of a Type Ia SN with an optical bump - SN 2019yvq]
- 20B-355, 21B-295 (12 hrs total, Triggered)
  [Young Type Ia supernovae in radio – a novel probe of progenitor scenarios]
- 20A-577 (1 hr)
  [VLA observation of the very young sub-luminous Type Ia SN 2020nlb]

- **e-MERLIN**
  - CY15208 (48 hrs)
    [e-MERLIN observations of the first JWST-detected supernova remnants in M33]

Co-Investigator

- **JWST**
  - GO 3707 (149 hrs, PI: A. Leroy)
    [A JWST Census of the Local Galaxy Population: Anchoring the Physics of the Matter Cycle]
  - GO 4256 (10.35 hrs, PI: A. Leroy)
    [Dust imaging of low metallicity molecular clouds in NGC 6822 and WLM]
  - GO 2987 (22.06 hrs, PI: A. Leroy)
    [Resolving HII Regions and ISM Structure Across the Milky Way Analog NGC 253]
- **Hubble**
  - GO 17833 (162 orbits, PI: J. Dalcanton)
    [Bringing HST to the VLA: The Interaction of Stars and Gas in the Local Group]
  - GO 17502 (169 orbits, PI: D. Thilker)
    [Resolving gas, star formation and feedback in nearby galaxies with an HST+JWST+ALMA Treasury]
- **ALMA**
  - 2024.1.00028.S (PI: J. Sun)
    [Beholding Massive Star Cluster Formation and Evolution with the "Evil Eye"]
  - 2024.1.01179.S (PI: R. Chown)
    [A Complete View of Low Metallicity Star Forming Complexes in the Local Group Dwarf NGC 6822]
  - 2024.1.00080.S, 2023.1.00686.S, 2022A-S023 (PI: E. Koch)
    [Linking Molecular Cloud Structure to Massive Star Formation: 5000 molecular clouds, filaments, and bubbles across M33]
- **Chandra**
  - Chandra Legacy Program 2023 (2.9 Ms, PI: S Mathur)
    [A Treasury Survey Probing the Baryon & Energy Cycle and X-ray Binary Evolution in Galaxies at High Angular Resolution]
  - 22700460 Cycle 22 (84 ks, PI: K. Nyland)
    [Pilot study of Radio-changing-state Quasars identified in the VLASS survey]
- **VLA:**
  - 24B-224 (176 hrs, PI: E Koch)
    [Resolved atomic ISM, HII regions and supernova remnants beyond the Local Group]
  - 24B-262 (15 hrs, PI: E Koch)
    [Comparing the Galactic and extragalactic gold-standard star formation tracers]
  - 20A-346 (1800 hrs, PI: A Leroy)
    [A VLA Local Group Legacy Survey - X-Proposal]

    - 20B-329 (8.58 hrs, PI: K Nyland)
      [The Radio SED Evolution of Compact and Variable Radio AGN Identified in VLASS]
    - 18A-467, 19A-110 (31.5 hrs total, PI: J. Maldonado)
      [The Search for Radio Supernova Remnants in M31]

- **SMA**: 2022A-S023 (PI: E. Koch)
  [Resolving the molecular gas fuelling IC 10's starburst on 2.5 pc scales]
- **VLBA:** 20A-201 (48 hrs, PI: Nyland K.)
  [Follow-up of VLASS AGN Transients at High redshift]
- **GMRT:** 38_040 (28 hrs, PI: Nyland K.)
  [Radio SED Modeling of Compact AGN with Extreme Radio Variability]

Institutional Research/Travel Awards

- 2019 AAS International Travel Grant, ∼$1800
- 2019 NASA/STSCI Travel Fund, ∼$800
- 2017 Andrew Mellon Pre-doctoral Fellowship, ∼$39,000
- 2016 Thomas-Lain Scholarship, $2000
- 2014 Best Speaker Award (shared w. Amanda Yoho out of 48 speakers), Neighborhood Workshop in Astrophysics and Cosmology, Pennsylvania State University

MENTORSHIP

Graduate Students

- **Jing Li (PhD-):** IMPRS HD, U. Heidelberg, w/ Dr. Kathryn Kreckel
  [Thesis: Supernova Remnants and Feedback in PHANGS-MUSE survey]
- **Ness Mayker Chen (PhD, 2024):** Ohio State University w/ Dr. Adam Leroy
  [Thesis: Supernova environments in the PHANGS survey]
- **Katie Bowen (MS, 2023):** Michigan State University w/ Dr. Laura Chomiuk
  [Thesis: Radio-continuum observations of IC 1613]

Undergraduate Students

- **Olivia Griffith (BS-):** Michigan State University
  [Radio observations of Type Ia-CSM Supernovae]
- **Grace Showerman (BS-):** Michigan State University
  [Radio observations of old Type Ia Supernovae]
- **Matthew Bartnick (BS, 2023):** Michigan State University (now PhD student at West Virginia University)
  [Radio observations of old Type Ia Supernovae]
- **Jordan Wagner (BS, 2023):** Ohio State University (now working in private sector)
  [Where do massive stars explode in the ISM?]
- **Yuxin Dong (BS, 2021):** Purdue University w/ Dr. Dan Milisavljevic (now PhD student at Northwestern University)
  [Physical Properties of the Host galaxies of Ca-rich Transients]
- **Jasmin Washington (BS,2020):** U Virginia (now PhD student in U. Arizona)
  [AAS 235: Constraining Type Ia Supernova Progenitor Environments with Late-Time Radio Observations – 307.11]

- **Hazirah Sanani (BS,2020):** Michigan State University
  [A Case Study of Nova Progenitors in the Andromeda Galaxy]
- **Mairead Heger (BS,2018):**, U. Pittsburgh (now PhD student at U. Toronto)
  [Delay-time distribution of variable stars]

RESEARCH PRESENTATIONS

Invited Talks

- Alpbach (Austria) 2024: *Clouds, Star Clusters & Black Holes*
- Center for Computational Astrophysics (Flatiron), 2024: *CCA-NY Galaxy Formation Seminars*
- U. Melbourne (Australia), 2023: *Astronomy Seminar*
- Gemini/Cerro Tololo Inter-American Observatory, 2021: *Science Coffee*
- AAS Journal Series, 2021 [Video]
- Ohio State University, 2021: *CCAPP Tuesday Seminar*
- Michigan State University, 2019: *Astronomy & Astrophysics Seminars*
- U. Chicago, 2017: *Astro Tuesday Series seminars*
- U. Michigan, 2017: *Extreme Astrophysics seminars*
- NOAO, 2017: *Friday Scientific Lunch Talks*
- U. Washington, 2017: *Astronomy Seminar*
- Ohio State University, 2017: *CCAPP Astroparticle Lunch*
- UC Santa Cruz, 2017: *Supernova Remnants Workshop*
- U Pittsburgh, 2016: *Astrolunch seminars*
- Carnegie Mellon University, 2015: *Astrostatistics seminar*

Contributed Talks

- New Mexico State University, 2024: *SDSS-V Collaboration Meeting*
- RACV Healsville (Australia), 2023: *New Views on Feedback & the Baryon Cycle in Galaxies*
- AAS 242, 2023 [Abstract]
- U Illinois Urbana-Champaign, 2023: *The Transient and Variable Universe* [Video]
- Vancouver (Canada) 2023: *New Eyes on the Universe: SKA and ngVLA* [Video]
- Caltech 2023: *Scientific Frontiers and Synergies for the DSA-2000 Radio Camera* [Video, starts at 1:41:42]
- KITP Santa Barbara, 2022: *White Dwarfs from Physics to Astrophysics* [Video]
- CfA Harvard, 2022: *Supernova Remnants and their Progenitors* [Video]
- Ohio State University, 2022: *CCAPP Fellows Symposium*
- SKA Observatory, 2021: *Virtual Conference: A Precursor View of the SKA Sky*
- U. Chicago, 2019: *Midwest Workshop on Supernova & Transients* [Abstract/slides]
- STSCI, 2019: *The Deaths and Afterlives of Stars* [Video]
- Chania (Greece) 2019: *Supernova Remnants: An Odyssey in Space after Stellar Death II* [Recording and Slides]
- AAS 231, 2018: Dissertation Talk [Abstract]
- Oregon State University, 2017: *FOE17 (Fifty-One-Erg)*
- Chania (Greece), 2016: *Supernova Remnants: An Odyssey in Space after Stellar Death I* [Recording and Slides]
- Penn State University, 2014: *Neighborhood Workshop in Astrophysics and Cosmology II*

Posters

- Chalmers University (Sweden) 2022: *From Stars to Galaxies II Connecting our understanding of star and galaxy formation*
- Flatiron Institute, 2022: *Computational Astrophysics in the ngVLA Era: Synergistic Simulations, Theory, and Observations*
- NRAO Socorro, 2017: *Developing the ngVLA Science Program Workshop*
- U. Michigan, 2015: *Local Group Astrostatistics*

TEACHING

- **Guest lecturer:** Topics in Astrophysics, 2022 (Instructor: Ji Wang)
- **Guest lecturer:** Galactic & Extra-galactic Astronomy, 2016 (Instructor: C. Badenes).
- **Teaching Assistant:** Stars, Galaxies and Cosmos, Fall 2013 (Instructor: M. Wood-Vasey)
- **Teaching Assistant:** Stars, Galaxies and Cosmos, Summer 2013 (Instructor: D. Turnshek)
- **Teaching Assistant:** Basics of Space Flight, Spring 2013 (Instructor: R. S. Ladbeck)
- **Teaching Assistant:** Basic Physics for Science and Engineering I, 2012 (Instructor: B. D'urso)
- **Grader:** Physics and Society, 2012 (Instructor: E. Gerjuoy)

OUTREACH AND DEI

- **Presenter:** Ohio State Fair, Physics Booth (2024)
- **Presenter:** OSU STEAM Exchange (2024)
- **Committee Member:** OSU Astronomy Diversity, Equity, and Inclusion Committee (2023-24)
- **Presenter:** Friends of Ohio State Astronomy & Astrophysics (2022)
- **Mentor:** NRAO NAC Program for under-represented STEM students (2019)
- **Presenter/Resident Astronomer:** Astronomy on Tap, Lansing [Video link] (2018-21)
- **Presenter:** Investing Now, U. Pittsburgh (2017)
- **Telescope Operator/Presenter:** White House Frontiers Conference Astronomy Night, Alleghany Observatory (2016)
- **Organizer:** Astrosnacks Career Development Seminars, U. Pittsburgh (2015-18)
- **Presenter:** Landolt Astronomical Observatory, Louisiana State University (2012)
- **Presenter:** Louisiana Junior Science and Humanities Symposium (for high-school students), Baton Rouge, LA (2011)

PROFESSIONAL SERVICE

- **Organizer:** 2022 CCAPP Fellows Symposium, OSU (w. William Luszczak)
- **Founder & Organizer:** U. Pittsburgh-Carnegie Mellon University *Astrosnacks* seminars.
- **Student Representative:** Astrophysics Faculty Search Committee, University of Pittsburgh
- **Judge:** Chambliss Student Awards, AAS 231, Washington DC
- **Reviewer:** ApJ, MNRAS

SCIENCE COLLABORATIONS

- **Physics at High Angular Resolution in Nearby GalaxieS (PHANGS, 2022-)**
  [This is a comprehensive cloud-scale survey of 77 nearby star-forming galaxies within 23 Mpc, with complete coverage from HST, JWST, VLA, ALMA, MUSE, MeerKAT, AstroSAT and Chandra. I am leading supernova feedback, remnants and progenitor science, including two student theses.]
- **Sloan Digital Sky Survey-V (2022–)**
  [I am part of the Local Volume Mapper Experiment of SDSS-V survey, working on IFU observations of supernova remnants and HII regions.]
- **Local Group L-Band Survey, (2020-)**
  [This is an 1800 hr VLA+GBT survey of six northern Local Group galaxies – M31, M33, NGC 6822, IC10, IC1613 and WLM. I am the lead radio continuum scientist, developing pipelines for data reduction, and leading the supernova remnant science.]
- **Very Large Array Sky Survey (VLASS, 2019-20)**
  [I was briefly part of the VLASS transients group, responsible for scheduling follow-ups, and contributing to AGN variability science.]
- **CHILES Variable & Explosive Radio Dynamic Evolution Survey (CHILES-VERDES, 2019-21)**
  [This is a concluded 1000 hr radio variability survey from 2013-2019 in the COSMOS field with the VLA, the deepest and longest of such surveys. I led the cataloguing and analysis of variable sources in the survey.]
- **ThunderKAT (2020-2023)**
  [This was the Transients collaboration with the MeerKAT telescope. I was part of the Type Ia supernova follow-up working group.]

REFERENCES

- Dr. Carles Badenes (U. Pittsburgh)
- Dr. Laura Chomiuk (Michigan State University)
- Dr. Adam Leroy (Ohio State University)