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PROFESSIONAL APPOINTMENTS

Current: Lasker Data Science Fellow, Space Telescope Science Institute
June 2017 – present

Previous: Postdoctoral Fellow, National Optical Astronomy Observatory
Jul 2013–Jun 2017[1]

EDUCATION

Harvard University	Ph.D. Physics, May 2013 **Advisor**: Professor Christopher W. Stubbs
Harvard University	A.M. Physics, May 2007
Illinois Wesleyan University	B.S. Physics, Summa Cum Laude May 2005

RESEARCH INTERESTS

- Cosmography and Cosmology
- Type Ia Supernovae
- Variables and Explosive Transients
- Wide Area Optical and NIR Surveys
- Astrostatistics and Machine Learning
- Photometric Calibration

RESEARCH HISTORY

The ANTARES Project

- Collaborated on NSF INSPIRE-funded project to develop system to characterize variable and transient sources on the sky from present and future wide-field surveys
- Presently testing and deploying on live alert streams
- Developing algorithms to extract physical attributes, or "features" from variable and transient alerts, and characterize those alerts, classifying them when appropriate
- Developing "touchstone" repository of information on known classes of astrophysical variables, and transients
- Developing cross-matched database containing information from various astronomical surveys, including SDSS, Pan-STARRS1, 2MASS, GAIA, WISE, NED, etc
- Demonstrated fully functional end-to-end version of ANTARES at IAU, "Hot Wiring the Transient Universe V", LSST JTM
- Project went through an external review process in Dec. 2016, and was highly rated by committee of astronomers and computer scientists

[1] Formally employed by The University of Arizona CS Dept. from Dec 2014–Apr 2016, but located at NOAO

The DA White Calibration Project

- Collaborated on project to establish network of faint, equatorial DA white dwarf stars as spectrophotometric calibration standards for future cosmological studies
- Co-I on *HST* GO 12967 (18 orbits), 13711 (60 orbits), and 15113 (54 orbits)
- Authored preliminary analysis of Cycle 20 data. Currently leading analysis of full Cycle 20 and Cycle 22 sample
- Developed DA white dwarf modeling code to extract effective temperature, surface gravity and reddening from observed spectroscopy
- Developed pipeline to process *HST* WFC3 images of DA White Dwarfs
- Discovered miscalibration of WFC3 quantum efficiency. This observation has now been verified by the Space Telescope Science Institute, and rectified for Cycle 22
- Developed schedule optimizer for LCO follow-up observations, and obtained high-S/N spectra of DA White Dwarfs at several large aperture telescopes

The ESSENCE Survey

- Performed photometric re-calibration and cosmological analysis of ESSENCE SNIa. Developed software for image de-trending and analysis
- Re-trained the MLCS light curve fitter using new data from low-z SNIa surveys
- Authored final 7-year data release and cosmological results paper
- Derived cosmological constraints of Dark Energy Equation-of-State, w, using ESSENCE and literature SNIa
- Constructed deep stacks to extract photometry of SNIa host-galaxies
- Participated in spectroscopy of SNIa and programmed software to select next observing field for imaging optimally

The Pan-STARRS Survey

- Working with Foundation SN team to finish cosmological analysis of PS1 + literature SNIa samples
- Collaborated on several projects studying unusual PS1 SN, and authored paper on SN 2009ku, an outlier amongst SN 2002cx-like objects. SN 2009ku has high luminosity and low decline compared to SN 2002cx-like objects, but spectra similar to low-luminosity, fast-declining, low ejecta velocity SN 2008ha
- Adapted ESSENCE pipeline to discover transients and perform photometry on PS1 Medium Deep Survey images (>600 TB of data processed, >400 spectroscopically confirmed SN)
- Coauthored initial SNIa data release and cosmological study with Pan-STARRS
- Developed novel transmissive flat-field screen to measure system throughput relative to NIST photodiode
- Participated in spectroscopic followup of PS1 SN

The CfA Supernova Group

- Helped evelop BayeSN, a novel program to determine distance moduli, extract light curve shape parameters and dust properties from optical+NIR data of low-z SNIa
- Working with RAISIN team on final analysis of *HST* WFC3 IR data
- Obtained several nights of imaging with Keplercam, and spectroscopy with FAST at FLWO, incorporated in the CfA3 and CfA4 data releases
- Adapted SuperMACHO pipeline to process PAIRITEL images and perform photometry

TEACHING HISTORY

Honors Thesis Advisor, National Optical Astronomy Observatory, 2016–7

- Advisor to Tayeb Zaidi (Macalester College), my former REU student, who has elected to continue his work in the NOAO Summer 2015 REU program for his Senior Honors Thesis (earned April 2017)

REU Advisor, National Optical Astronomy Observatory, 2014, 2015

- Advisor to Marcus Admiral Lee (TOCC/UA, 2014), and Tayeb Zaidi (Macalester College, 2015)
- Taught students various concepts in astronomy, statistics, and programming

Additionally served as Teaching Assistant at Harvard, and Teaching Assistant, Lab Assistant and Tutor at Illinois Wesleyan

OBSERVING EXPERIENCE

Magellan Observatory: 7 nights LDSS3 imaging, and long-slit spectroscopy
MMT Observatory: 15 nights of Blue Channel spectroscopy on site, 2 nights of remote observing
F. L. Whipple Observatory: several nights of long-slit spectroscopy on the 1.5 m with FAST and imaging on the 1.2 m with Keplercam, both on-site and remote
Kitt Peak National Observatory: several nights of imaging on the 4 m with MOSAIC 1.1 & MOSAIC 3
WIYN Observatory: 3 nights of imaging on the WIYN 3.5 m with ODI
Cerro-Tololo Inter-American Observatory: 5 nights of imaging on the 0.9 m with Tek2K

PROFESSIONAL MEMBERSHIP

American Astronomical Society, Junior Member 2007–
American Physical Society, Junior Member 2001–2005

SOFTWARE PROFICIENCIES

- Developer on several packages available at http://github.com/gnarayan
- Experienced with Python, IDL, Perl, C++ and IRAF
- Comfortable with C, R, Java and Fortran
- Some familiarity with Scheme, ML, Haskell, and PhP
- Experienced with National Instruments LabVIEW, ZeMAX and other software for design
- Experienced with HTCondor, LSF and SGE high-throughput computing environments
- Some familiarity with Amazon Web Services and XSEDE and programming using MapReduce on Hadoop

COLLOQUIA/SEMINARS/CONFERENCES

LSST Photometric Classification Challenge "PLAsTiCC" Workshop - New York, NY, Jul. 2017
Supernovae: The LSST Revolution - Evanston, IL, Jun. 2017
Building the Infrastructure for Time-Domain Alert Science in the LSST Era - Tucson, AZ, May 2017
Hot Wiring the Transient Universe V - Philadelphia, PA, Oct. 2016
Photometric Classification of Supernovae workshop - Chicago, IL, Apr. 2016
LSST Joint Technical Meeting - Santa Cruz, CA, Feb 2016
Hot Wiring the Transient Universe IV - Santa Barbara, CA, May 2015
Illinois Wesleyan University Natural Science Colloquium - Bloomington, IL, Apr. 2015
Tools for Astronomical Big Data - Tucson, AZ, March 2015
American Astronomical Society Meeting #225 - Seattle, WA, Jan. 2015
American Astronomical Society Meeting #224 - Boston, MA, Jun. 2014
American Astronomical Society Meeting #219 - Austin, TX, Jan. 2012
American Astronomical Society Meeting #215 - Washington, D.C., Jan. 2010
A Festival of Cosmic Explosions - Pasadena, CA, Aug. 2009
Stellar Death and Supernovae - Santa Barbara, CA, Aug. 2009
American Astronomical Society Meeting #214 - Pasadena, CA, Jun. 2009
American Astronomical Society Meeting #211 - Austin, TX, Jan. 2007
Summer School in Statistics for Astronomers and Physicists II- Pennsylvania State University, Jun. 2006

INSTRUCTION, SERVICE & PUBLIC OUTREACH WORK

Instructor, LSST Data Science Fellowship Program, Session 3, Apr. 2017
Instructor, NOAO Big Data Workshop for Tucson High School Students, Session 1, Jan. 2017
Instructor, Python Workshop for NOAO/NSO REU Students, 2014, 2015
Guest Lecturer, Tohono O'odham Community College, Dec. 2014

Reviewer for the Astrophysical Journal, ongoing
LOC, Building the Infrastructure for Time-Domain Alert Science in the LSST Era, May 2017
Co-organizer, Astronomy on Tap - Tucson/Space Drafts, 2015-2017
Organizer, NOAO FLASH Talk Series, 2015–2017
Organizer, NOAO Coffee Hour Series, 2014–5

Scientist, TED-Ed Original Videos (Pt. 1) (Pt. 2)
365 Days of Astronomy Podcast (Pt. 1) (Pt. 2)
Panelist, Tucson Comic Con and TUSCon, Nov. 2015 and 2016
"Robots in Space" and "The Physics of Space Battles"
Speaker, Astronomy on Tap - Tucson, Jan. 2015, Oct. 2016
"If You Only Knew The Power of The Dark Side" and "A Trip through Gustav Holst's Planets"
Volunteer, Science Night, Elvira Elementary School, Tucson, AZ, Mar. 2015 and Mar. 2017
Speaker, Green Valley Astronomy Club, Sahuarita, AZ, May 2016
Volunteer, Astronomy Night, Arizona Sonoran Desert Museum, Jul. 2015
Volunteer, Kitt Peak National Observatory Open Night for the Tohono O'odham Nation, May 2015
Volunteer, Tucson Festival of Books, Mar. 2015
Volunteer, Museum of Science, Boston, MA, 2011–2
Volunteer, Mark Evans Observatory, Bloomington, IL, 2001–5

REFERENCES

Dr. Abhijit Saha	National Optical Astronomy Observatory 950 N. Cherry Ave., Rm. 116 Tucson, AZ, 85719 (520) 318 8288 *saha@noao.edu*
Prof. Christopher Stubbs	Dept of Physics, Harvard University 17 Oxford St., Lyman 355 Cambridge, MA, 02138 (617) 495 1454 *stubbs@physics.harvard.edu*
Dr. Thomas Matheson	National Optical Astronomy Observatory 950 N. Cherry Ave., NSSDC Tucson, AZ, 85719 (520) 318 8517 *matheson@noao.edu*
Dr. Armin Rest	Space Telescope Science Institute 3700 San Martin Dr., #434 Baltimore, MD, 21218 (410) 338-4358 *arest@stsci.edu*
Prof. Ryan Foley	Dept of Astronomy & Astrophysics, University of California, Santa Cruz 1156 High St., ISB 345 Santa Cruz, CA, 95064 (831) 459-2835 *foley@ucsc.edu*
Prof. Robert Kirshner	Dept of Astronomy, Harvard University 60 Garden St., MS 19 Cambridge, MA, 02138 (617) 496-7519 *rkirshner@cfa.harvard.edu*

LIST OF PUBLICATIONS

[1] **Light Curves of 213 Type Ia Supernovae from the ESSENCE Survey**. **G. Narayan**, A. Rest, B. E. Tucker, R. J. Foley, W. M. Wood-Vasey, P. Challis, C. Stubbs, R. P. Kirshner, C. Aguilera, A. C. Becker, S. Blondin, A. Clocchiatti, R. Covarrubias, G. Damke, T. M. Davis, A. V. Filippenko, M. Ganeshalingam, A. Garg, P. M. Garnavich, M. Hicken, S. W. Jha, K. Krisciunas, B. Leibundgut, W. Li, T. Matheson, G. Miknaitis, G. Pignata, J. L. Prieto, A. G. Riess, B. P. Schmidt, J. M. Silverman, R. C. Smith, J. Sollerman, J. Spyromilio, N. B. Suntzeff, J. L. Tonry, and A. Zenteno. *Astrophys. J. Suppl. Ser.*, May 2016. 224:3.

[2] **Toward a Network of Faint DA White Dwarfs as High-precision Spectrophotometric Standards**. **G. Narayan**, T. Axelrod, J. B. Holberg, T. Matheson, A. Saha, E. Olszewski, J. Claver, C. W. Stubbs, R. C. Bohlin, S. Deustua, and A. Rest. *Astrophys. J.*, May 2016. 822:67.

[3] **Displaying the Heterogeneity of the SN 2002cx-like Subclass of Type Ia Supernovae with Observations of the Pan-STARRS-1 Discovered SN 2009ku**. **G. Narayan**, R. J. Foley, E. Berger, M. T. Botticella, R. Chornock, M. E. Huber, A. Rest, D. Scolnic, S. Smartt, S. Valenti, A. M. Soderberg, W. S. Burgett, K. C. Chambers, H. A. Flewelling, G. Gates, T. Grav, N. Kaiser, R. P. Kirshner, E. A. Magnier, J. S. Morgan, P. A. Price, A. G. Riess, C. W. Stubbs, W. E. Sweeney, J. L. Tonry, R. J. Wainscoat, C. Waters, and W. M. Wood-Vasey. *Astrophys. J. Lett.*, Apr. 2011. 731:L11.

[4] A. Saha, Z. Wang, T. Matheson, **G. Narayan**, R. Snodgrass, J. Kececioglu, C. Scheidegger, T. Axelrod, T. Jenness, S. Ridgway, R. Seaman, C. Taylor, J. Toeniskoetter, E. Welch, S. Yang, and T. Zaidi. **ANTARES: Progress towards building a 'Broker' of time-domain alerts**. In *Observatory Operations: Strategies, Processes, and Systems VI*, vol. 9910 of *Proceedings of the SPIE*. Nov. 2016 .

[5] **Type Ia Supernova Light Curve Inference: Hierarchical Models in the Optical and Near-infrared**. K. S. Mandel, **G. Narayan**, and R. P. Kirshner. *Astrophys. J.*, Apr. 2011. 731:120.

[6] **SN 2006bt: A Perplexing, Troublesome, and Possibly Misleading Type Ia Supernova**. R. J. Foley, **G. Narayan**, P. J. Challis, A. V. Filippenko, R. P. Kirshner, J. M. Silverman, and T. N. Steele. *Astrophys. J.*, Jan. 2010. 708:pp. 1748–1759.

[7] **The Changing Fractions of Type Ia Supernova NUV–Optical Subclasses with Redshift**. P. A. Milne, R. J. Foley, P. J. Brown, and **G. Narayan**. *Astrophys. J.*, Apr. 2015. 803:20.

[8] A. Saha, T. Matheson, R. Snodgrass, J. Kececioglu, **G. Narayan**, R. Seaman, T. Jenness, and T. Axelrod. **ANTARES: a prototype transient broker system**. In *Observatory Operations: Strategies, Processes, and Systems V*, vol. 9149 of *Proceedings of the SPIE*. Jul. 2014 p. 914908.

[9] **The GALEX Time Domain Survey. II. Wavelength-Dependent Variability of Active Galactic Nuclei in the Pan-STARRS1 Medium Deep Survey**. T. Hung, S. Gezari, D. O. Jones, R. P. Kirshner, R. Chornock, E. Berger, A. Rest, M. Huber, **G. Narayan**, D. Scolnic, C. Waters, R. Wainscoat, D. C. Martin, K. Forster, and J. D. Neill. *Astrophys. Journal*, Dec. 2016. 833:226.

[10] **CfAIR2: Near-infrared Light Curves of 94 Type Ia Supernovae**. A. S. Friedman, W. M. Wood-Vasey, G. H. Marion, P. Challis, K. S. Mandel, J. S. Bloom, M. Modjaz, **G. Narayan**, M. Hicken, R. J. Foley, C. R. Klein, D. L. Starr, A. Morgan, A. Rest, C. H. Blake,

A. A. Miller, E. E. Falco, W. F. Wyatt, J. Mink, M. F. Skrutskie, and R. P. Kirshner. *Astrophys. J. Suppl. Ser.*, Sep. 2015. 220:9.

[11] **PS1-10jh Continues to Follow the Fallback Accretion Rate of a Tidally Disrupted Star**. S. Gezari, R. Chornock, A. Lawrence, A. Rest, D. O. Jones, E. Berger, P. M. Challis, and **G. Narayan**. *Astrophys. J. Lett.*, Dec. 2015. 815:L5.

[12] **Cosmological Constraints from Measurements of Type Ia Supernovae Discovered during the First 1.5 yr of the Pan-STARRS1 Survey**. A. Rest, D. Scolnic, R. J. Foley, M. E. Huber, R. Chornock, **G. Narayan**, J. L. Tonry, E. Berger, A. M. Soderberg, C. W. Stubbs, A. Riess, R. P. Kirshner, S. J. Smartt, E. Schlafly, S. Rodney, M. T. Botticella, D. Brout, P. Challis, I. Czekala, M. Drout, M. J. Hudson, R. Kotak, C. Leibler, R. Lunnan, G. H. Marion, M. McCrum, D. Milisavljevic, A. Pastorello, N. E. Sanders, K. Smith, E. Stafford, D. Thilker, S. Valenti, W. M. Wood-Vasey, Z. Zheng, W. S. Burgett, K. C. Chambers, L. Denneau, P. W. Draper, H. Flewelling, K. W. Hodapp, N. Kaiser, R.-P. Kudritzki, E. A. Magnier, N. Metcalfe, P. A. Price, W. Sweeney, R. Wainscoat, and C. Waters. *Astrophys. J.*, Nov. 2014. 795:44.

[13] **Systematic Uncertainties Associated with the Cosmological Analysis of the First Pan-STARRS1 Type Ia Supernova Sample**. D. Scolnic, A. Rest, A. Riess, M. E. Huber, R. J. Foley, D. Brout, R. Chornock, **G. Narayan**, J. L. Tonry, E. Berger, A. M. Soderberg, C. W. Stubbs, R. P. Kirshner, S. Rodney, S. J. Smartt, E. Schlafly, M. T. Botticella, P. Challis, I. Czekala, M. Drout, M. J. Hudson, R. Kotak, C. Leibler, R. Lunnan, G. H. Marion, M. McCrum, D. Milisavljevic, A. Pastorello, N. E. Sanders, K. Smith, E. Stafford, D. Thilker, S. Valenti, W. M. Wood-Vasey, Z. Zheng, W. S. Burgett, K. C. Chambers, L. Denneau, P. W. Draper, H. Flewelling, K. W. Hodapp, N. Kaiser, R.-P. Kudritzki, E. A. Magnier, N. Metcalfe, P. A. Price, W. Sweeney, R. Wainscoat, and C. Waters. *Astrophys. J.*, Nov. 2014. 795:45.

[14] **Survey requirements for accurate and precise photometric redshifts for Type Ia supernovae**. Y. Wang, **G. Narayan**, and M. Wood-Vasey. *Mon. Not. R. Astron. Soc.*, Nov. 2007. 382:pp. 377–381.

[15] **Toward Characterization of the Type IIP Supernova Progenitor Population: A Statistical Sample of Light Curves from Pan-STARRS1**. N. E. Sanders, A. M. Soderberg, S. Gezari, M. Betancourt, R. Chornock, E. Berger, R. J. Foley, P. Challis, M. Drout, R. P. Kirshner, R. Lunnan, G. H. Marion, R. Margutti, R. McKinnon, D. Milisavljevic, **G. Narayan**, A. Rest, E. Kankare, S. Mattila, S. J. Smartt, M. E. Huber, W. S. Burgett, P. W. Draper, K. W. Hodapp, N. Kaiser, R. P. Kudritzki, E. A. Magnier, N. Metcalfe, J. S. Morgan, P. A. Price, J. L. Tonry, R. J. Wainscoat, and C. Waters. *Astrophys. J.*, Feb. 2015. 799:208.

[16] **Zooming In on the Progenitors of Superluminous Supernovae With the HST**. R. Lunnan, R. Chornock, E. Berger, A. Rest, W. Fong, D. Scolnic, D. O. Jones, A. M. Soderberg, P. M. Challis, M. R. Drout, R. J. Foley, M. E. Huber, R. P. Kirshner, C. Leibler, G. H. Marion, M. McCrum, D. Milisavljevic, **G. Narayan**, N. E. Sanders, S. J. Smartt, K. W. Smith, J. L. Tonry, W. S. Burgett, K. C. Chambers, H. Flewelling, R.-P. Kudritzki, R. J. Wainscoat, and C. Waters. *Astrophys. J.*, May 2015. 804:90.

[17] **Selection of Burst-like Transients and Stochastic Variables Using Multi-band Image Differencing in the PAN-STARRS1 Medium-deep Survey**. S. Kumar, S. Gezari, S. Heinis, R. Chornock, E. Berger, A. Rest, M. E. Huber, R. J. Foley, **G. Narayan**, G. H. Marion, D. Scolnic, A. Soderberg, A. Lawrence, C. W. Stubbs, R. P. Kirshner, A. G. Riess,

S. J. Smartt, K. Smith, W. M. Wood-Vasey, W. S. Burgett, K. C. Chambers, H. Flewelling, N. Kaiser, N. Metcalfe, P. A. Price, J. L. Tonry, and R. J. Wainscoat. *Astrophys. J.*, Mar. 2015. 802:27.

[18] **Possible Detection of the Stellar Donor or Remnant for the Type Iax Supernova 2008ha**. R. J. Foley, C. McCully, S. W. Jha, L. Bildsten, W.-f. Fong, **G. Narayan**, A. Rest, and M. D. Stritzinger. *Astrophys. J.*, Sep. 2014. 792:29.

[19] **Rapidly Evolving and Luminous Transients from Pan-STARRS1**. M. R. Drout, R. Chornock, A. M. Soderberg, N. E. Sanders, R. McKinnon, A. Rest, R. J. Foley, D. Milisavljevic, R. Margutti, E. Berger, M. Calkins, W. Fong, S. Gezari, M. E. Huber, E. Kankare, R. P. Kirshner, C. Leibler, R. Lunnan, S. Mattila, G. H. Marion, **G. Narayan**, A. G. Riess, K. C. Roth, D. Scolnic, S. J. Smartt, J. L. Tonry, W. S. Burgett, K. C. Chambers, K. W. Hodapp, R. Jedicke, N. Kaiser, E. A. Magnier, N. Metcalfe, J. S. Morgan, P. A. Price, and C. Waters. *Astrophys. J.*, Oct. 2014. 794:23.

[20] **Hydrogen-poor Superluminous Supernovae and Long-duration Gamma-Ray Bursts Have Similar Host Galaxies**. R. Lunnan, R. Chornock, E. Berger, T. Laskar, W. Fong, A. Rest, N. E. Sanders, P. M. Challis, M. R. Drout, R. J. Foley, M. E. Huber, R. P. Kirshner, C. Leibler, G. H. Marion, M. McCrum, D. Milisavljevic, **G. Narayan**, D. Scolnic, S. J. Smartt, K. W. Smith, A. M. Soderberg, J. L. Tonry, W. S. Burgett, K. C. Chambers, H. Flewelling, K. W. Hodapp, N. Kaiser, E. A. Magnier, P. A. Price, and R. J. Wainscoat. *Astrophys. J.*, Jun. 2014. 787:138.

[21] **The Ultraviolet-bright, Slowly Declining Transient PS1-11af as a Partial Tidal Disruption Event**. R. Chornock, E. Berger, S. Gezari, B. A. Zauderer, A. Rest, L. Chomiuk, A. Kamble, A. M. Soderberg, I. Czekala, J. Dittmann, M. Drout, R. J. Foley, W. Fong, M. E. Huber, R. P. Kirshner, A. Lawrence, R. Lunnan, G. H. Marion, **G. Narayan**, A. G. Riess, K. C. Roth, N. E. Sanders, D. Scolnic, S. J. Smartt, K. Smith, C. W. Stubbs, J. L. Tonry, W. S. Burgett, K. C. Chambers, H. Flewelling, K. W. Hodapp, N. Kaiser, E. A. Magnier, D. C. Martin, J. D. Neill, P. A. Price, and R. Wainscoat. *Astrophys. J.*, Jan. 2014. 780:44.

[22] **Slowly fading super-luminous supernovae that are not pair-instability explosions**. M. Nicholl, S. J. Smartt, A. Jerkstrand, C. Inserra, M. McCrum, R. Kotak, M. Fraser, D. Wright, T.-W. Chen, K. Smith, D. R. Young, S. A. Sim, S. Valenti, D. A. Howell, F. Bresolin, R. P. Kudritzki, J. L. Tonry, M. E. Huber, A. Rest, A. Pastorello, L. Tomasella, E. Cappellaro, S. Benetti, S. Mattila, E. Kankare, T. Kangas, G. Leloudas, J. Sollerman, F. Taddia, E. Berger, R. Chornock, **G. Narayan**, C. W. Stubbs, R. J. Foley, R. Lunnan, A. Soderberg, N. Sanders, D. Milisavljevic, R. Margutti, R. P. Kirshner, N. Elias-Rosa, A. Morales-Garoffolo, S. Taubenberger, M. T. Botticella, S. Gezari, Y. Urata, S. Rodney, A. G. Riess, D. Scolnic, W. M. Wood-Vasey, W. S. Burgett, K. Chambers, H. A. Flewelling, E. A. Magnier, N. Kaiser, N. Metcalfe, J. Morgan, P. A. Price, W. Sweeney, and C. Waters. *Nature*, Oct. 2013. 502:pp. 346–349.

[23] **PS1-10afx at z = 1.388: Pan-STARRS1 Discovery of a New Type of Superluminous Supernova**. R. Chornock, E. Berger, A. Rest, D. Milisavljevic, R. Lunnan, R. J. Foley, A. M. Soderberg, S. J. Smartt, A. J. Burgasser, P. Challis, L. Chomiuk, I. Czekala, M. Drout, W. Fong, M. E. Huber, R. P. Kirshner, C. Leibler, B. McLeod, G. H. Marion, **G. Narayan**, A. G. Riess, K. C. Roth, N. E. Sanders, D. Scolnic, K. Smith, C. W. Stubbs, J. L. Tonry, S. Valenti, W. S. Burgett, K. C. Chambers, K. W. Hodapp, N. Kaiser, R.-P. Kudritzki, E. A. Magnier, and P. A. Price. *Astrophys. J.*, Apr. 2013. 767:162.

[24] **PS1-10bzj: A Fast, Hydrogen-poor Superluminous Supernova in a Metal-poor Host Galaxy**. R. Lunnan, R. Chornock, E. Berger, D. Milisavljevic, M. Drout, N. E. Sanders, P. M. Challis, I. Czekala, R. J. Foley, W. Fong, M. E. Huber, R. P. Kirshner, C. Leibler, G. H. Marion, M. McCrum, **G. Narayan**, A. Rest, K. C. Roth, D. Scolnic, S. J. Smartt, K. Smith, A. M. Soderberg, C. W. Stubbs, J. L. Tonry, W. S. Burgett, K. C. Chambers, R.-P. Kudritzki, E. A. Magnier, and P. A. Price. *Astrophys. J. Lett.*, Jul. 2013. 771:97.

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