Dr. Leo P. Singer

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Areas of Specialization

Astronomy · Gravitational Waves · Optical Transients · Gamma-Ray Bursts
Bayesian Inference · Open-Source Astronomy Software · Data Visualization

Education & Employment

2017-present Research Astrophysicist (Civil Servant)

2014-2016 NASA Postdoctoral Program Fellow

2015 Ph.D. in Physics, California Institute of Technology
Thesis Title: "From *Fermi* GRBs to LIGO Discoveries: The Needle in the 100 deg^2 Haystack"

2009 B.Sc. in Physics, University of Maryland

Honors, Appointments, & Awards

2019–21 Project Scientist, Dorado

2015–17 Co-Chair, Electromagnetic Follow-Up Working Group, LIGO Scientific Collaboration

2016 co-recipient, Milner Breakthrough Prize in Fundamental Physics

2014 GWIC Thesis Prize

2013–14 John and Ursula Kanel Charitable Foundation Scholar

2010–13 Graduate Research Fellow, National Science Foundation

2012 Best Poster, LSC-Virgo Collaboration Meeting, Rome

Selected Publications

2022 **Singer**, Parazin, Coughlin, et al., "HEALPix Alchemy: Fast All-Sky Geometry and Image Arithmetic in a Relational Database for Multimessenger Astronomy Brokers", *Astronomical Journal*, 163: 209

2022 Martinez-Castellanos, **Singer**, Burns, et al., "Multi-Resolution HEALPix Maps for Multi-Wavelength and Multi-Messenger Astronomy", *Astronomical Journal*, 163: 259

2022 Petrov, **Singer**, Coughlin, et al., "Data-Driven Expectations for Electromagnetic Counterpart Searches Based on LIGO/Virgo Public Alerts", *Astrophysical Journal* 924: 54

2021 Ahumada, **Singer**, Anand, et al., "Discovery and Confirmation of the Shortest Gamma Ray Burst with a Collapsar", *Nature Astronomy* 5: 917

2021 Magee, Chatterjee, **Singer**, et. al., "First Demonstration of Early Warning Gravitational Wave Alerts", *Astrophysical Journal Letters* 910: 21

2021 Anand et al., "Optical Follow-Up of the Neutron Star-Black Hole Mergers S200105ae and S200115j", *Nature Astronomy* 5: 46

2020 Sachdev, Magee, Hanna, Cannon, **Singer**, et al., "An Early-warning System for Electromagnetic Follow-up of Gravitational-wave Events", *Astrophysical Journal Letters* 905: 25

2020 Messick et al., "Automating the Inclusion of Subthreshold Signal-to-Noise Ratios for Rapid Gravitational-Wave Localization", submitted to *Physical Review D*

2020 Bhakta et al., "The JAGWAR Prowls LIGO/Virgo O3 Paper I: Radio Search of a Possible Multi-Messenger Counterpart of the Binary Black Hole Merger Candidate S191216ap", *Astrophysical Journal* 911: 77

2020 Almualla et al., "Dynamic Scheduling: Target of Opportunity Observations of Gravitational Wave Events", *Monthly Notices of the Royal Astronomical Society* 495: 4366

2019 Andreoni, Goldstein, Anand, Coughlin, **Singer**, et al., "GROWTH on S190510g: DECam Observation Planning and Follow-up of a Distant Binary Neutron Star Merger Candidate", *Astrophysical Journal Letters* 881: 16

2019 Goldstein et al., "GROWTH on S190426c: Real-time Search for a Counterpart to the Probable Neutron Star–Black Hole Merger using an Automated Difference Imaging Pipeline for DECam", *Astrophysical Journal Letters* 881: 7

2019 Andreoni et al., "A Strategy for LSST to Unveil a Population of Kilonovae without Gravitational-wave Triggers", *Publications of the Astronomical Society of the Pacific* 131: 068004

2019 Ginsburg et al., "Astroquery: An Astronomical Web-querying Package in Python", *Astronomical Journal* 157: 98

2019 Corley, Bartos, **Singer**, et al., "Localization of Binary Black Hole Mergers with Known Inclination", *Monthly Notices of the Royal Astronomical Society* 488: 4459

2019 Huerta et al., "Enabling Real-Time Multi-Messenger Astrophysics Discoveries with Deep Learning", *Nature Reviews Physics* 1: 600

2019 Coughlin et al., "GROWTH on S190425z: Searching Thousands of Square Degrees to Identify an Optical or Infrared Counterpart to a Binary Neutron Star Merger with the Zwicky Transient Facility and Palomar Gattini-IR", *Astrophysical Journal Letters* 885: 19

2019 Zonca, Singer, Lenz, et al., "Healpy: Equal Area Pixelization and Spherical Harmonics Transforms for Data on the Sphere in Python", *Journal of Open Source Software* 4: 1298

2018 Del Pozzo, Berry, Ghosh, Haines, **Singer**, & Vecchio, "Dirichlet Process Gaussian-Mixture Model: An Application to Localizing Coalescing Binary Neutron Stars with Gravitational-Wave Observations", *Monthly Notices of the Royal Astronomical Society* 479: 601

2018 Mooley, Frail, Myers, Kulkarni, Hotokezaka, **Singer**, et al., "A Case Study of On-the-fly Wide-field Radio Imaging Applied to the Gravitational Wave Event GW151226", *Astrophysical Journal* 857: 143

2017 Kasliwal, Nakar, **Singer**, et. al., "Illuminating gravitational waves: A concordant picture of photons from a neutron star merger", *Science* 358: 1559

2017 Arcavi, McCully, Hosseinzadeh, Howell, Vasylyev, Poznanski, Zaltzman, Maoz, **Singer**, et al., "Optical Follow-up of Gravitational-wave Events with Las Cumbres Observatory", *Astrophysical Journal Letters* 848: 33

2017 LIGO Scientific Collaboration and Virgo Collaboration, "GW170817: Observation of Gravitational Waves from a Binary Neutron Star Inspiral", *Physical Review Letters* 119: 161101

2017 **Singer**, Chen, Holz, et al., "GW170817: Observation of Gravitational Waves from a Binary Neutron Star Inspiral", *Physical Review Letters* 119: 161101

2016 **Singer**, Chen, Holz, et al., "Going the Distance: Mapping Host Galaxies of LIGO and Virgo Sources in Three Dimensions Using Local Cosmography and Targeted Follow-up", *Astrophysical Journal Letters* 829: 15

2016 **(note: corresponding author)** "Localization and Broadband Follow-Up of the Gravitational-Wave Transient GW150914", *Astrophysical Journal Letters* 826: 13

2016 Kasliwal, Cenko, **Singer**, et al., "iPTF Search for an Optical Counterpart to Gravitational Wave Transient GW150914", *Astrophysical Journal Letters* 824: 24

2016 Connaughton et al., "Fermi GBM Observations of LIGO Gravitational Wave Event GW150914", *Astrophysical Journal Letters* 826: 6

2016 LIGO Scientific Collaboration *&* Virgo, "Observation of Gravitational Waves from a Binary Black Hole Merger", *Physical Review Letters* 116: 061102

2016 Gehrels, Cannizzo, Kanner, Kasliwal, Nissanke, *&* **Singer**, "Galaxy Strategy for LIGO-Virgo Gravitational Wave Counterpart Searches", *Astrophysical Journal* 820: 136

2016 LIGO Scientific Collaboration *&* Virgo, "Prospects for Localization of Gravitational Wave Transients by the Advanced LIGO and Advanced Virgo Observatories", *Living Reviews in Relativity* 19: 1

2016 **Singer** *&* Price, "Rapid Bayesian Position Reconstruction for Gravitational-Wave Transients", *Physical Review D* 93: 024013

2015 **Singer**, Kasliwal, Cenko, Perley, et al., "The Needle in the 100 deg^2 Haystack: Uncovering Afterglows of *Fermi* GRBs with the Palomar Transient Factory", *Astrophysical Journal* 806: 52

2015 Berry, Mandel, Middleton, **Singer**, et al., "Parameter Estimation for Binary Neutron-Star Coalescences with Realistic Noise During the Advanced LIGO Era", *Astrophysical Journal* 804: 114

2014 **Singer**, Price, Farr, et al., "The First Two Years of Electromagnetic Follow-Up with Advanced LIGO and Virgo", *Astrophysical Journal* 795: 105

2013 **Singer**, Cenko, Kasliwal, Perley, et al., "Discovery and Redshift of an Optical Afterglow in 71 deg^2: iPTF13bxl and GRB 130702A", *Astrophysical Journal Letters* 776: 34

2013 Robitaille et al., "Astropy: A Community Python Package for Astronomy", *Astronomy & Astrophysics* 558: A33

2013 Dietz, Fotopoulos, **Singer**, *&* Cutler, "Outlook for Detection of GW Inspirals by GRB-Triggered Searches in the Advanced Detector Era", *Physical Review D* 87: 064033

2012 **(note: corresponding author)** Cannon et al., "Toward Early-warning Detection of Gravitational Waves from Compact Binary Coalescence", *Astrophysical Journal* 748: 136

Selected Invited Talks

2019 *LSST Detection of Optical Counterparts of Gravitational Waves*, Columbia University, New York City, NY

2018 *Miami 2018 Topical Conference on Elementary Particles, Astrophysics, & Cosmology*, Fort Lauderdale, FL

2018 *3rd PANDA Symposium*, Chengdu, China

2018 **Keynote Talk**, *SciPy 2018*

2017 **Plenary Talk**, *29th meeting of the Indian Association for General Relativity and Gravitation*, Indian Institute of Technology, Guwahati, India

2016 *7 years of MAXI : Monitoring X-ray Transients*, RIKEN, Japan

2016 *Supernovae Through the Ages*, Easter Island, Chile

2016 *LIGO Dawn II Workshop*, Georgia Institute of Technology, Atlanta, GA

2016 Physics & Astronomy Department Colloquium, Johns Hopkins University, Baltimore, MD

2016 Physics Department Colloquium, George Washington University, Washington, DC

2016 Kavli Institute Colloquium, Massachusetts Institute of Technology, Cambridge, MA

2016 "Multimessenger Astronomy with LIGO and the Zwicky Transient Facility", *Astrophysical Multimessenger Observatory Network Workshop*, Pennsylvania State University, State College, PA

2015 **Plenary Talk**, "The Needle in the Hundred-Square-Degree Haystack: The Hunt for Binary Neutron Star Mergers with LIGO and Palomar Transient Factory", *11th Edoardo Amaldi Conference on Gravitational Waves*, Gwangju, South Korea

2015 "Compact Binary Mergers in the Era of Advanced LIGO", *General Relativity & Gravitation: A Centennial Perspective*, Penn. State University, State College, PA

2015 "Gravitational Wave Observations and Optical Follow-up with Advanced LIGO", *Improving Data Mobility & Management for International Cosmology*, Lawrence Berkeley National Lab, Berkeley, CA

2013 "The Needle in the Hundred-Square-Degree Haystack: from Fermi GRBs to LIGO Discoveries", *Hot-Wiring the Transient Universe III*, Santa Fe, NM

2013 "Relativistic Explosions with Palomar Transient Factory", *Gamma-ray Bursts: New Missions to New Science*, Skobeltsyn Institute of Nuclear Physics of Moscow State University, Moscow, Russia

2013 "HTCondor in MacPorts", *HTCondor Week*, University of Wisconsin, Madison, WI

Service to Profession

2020 Proposal Reviewer, UK Science and Technology Facilities Council

2017 Proposal Reviewer, US National Science Foundation

2016 Session Chair at April 2016 American Physical Society Meeting

2015 Session Chair at April 2015 American Physical Society Meeting

Teaching & Outreach

2019 "Gravity in Science Fact and Science Fiction", Public Lecture at DC Public Library for *Astronomy on Tap*, Washington, DC

2018 "Black and Gold: The Astrophysics of LIGO Signals", Public Observatory Talk at George Mason University, Fairfax, VA

2017 "Advanced LIGO: Hearing the Sound of Gravity", Public Lecture at University of Maryland Observatory, Greenbelt, MD

2016 "LIGO: How Gravitational Waves Taught me to Stop Worrying and Love the Bomb", Public Lecture for *Astronomy on Tap*, Washington, DC

2010–13 Mentor for LIGO Summer Undergraduate Research Fellowship

2011 Teaching assistant for the course "Waves, Quantum Mechanics, and Statistical Physics", California Institute of Technology, Pasadena, CA

2011 Lecture for LIGO Summer Undergraduate Research Fellowship program, "Introduction to Digital

Signal Processing", California Institute of Technology, Pasadena, CA

Selected Contributions to Open-Source Software

Astropy · Matplotlib · SciPy · HEALPix · GWPy · ligo.skymap · PyGCN · MacPorts · Debian · HTCondor · GStreamer · gcn.nasa.gov · librdkafka · Confluent Kafka · Remix

Other Qualifications

Eligible for Top Secret clearance with SCI access (full scope polygraph, April 11, 2006)