

CONTACT INFORMATION	Institute for Theory & Computation Harvard-Smithsonian Center for Astrophysics 60 Garden Street, Cambridge, MA 02138, USA	+1 (617) 858-6595 www.kiziltan.org bkiziltan@cfa.harvard.edu
EDUCATION	<p>University of California, Santa Cruz (M.Sc., Ph.D.); Astronomy & Astrophysics, 2004 – 2010</p> <ul style="list-style-type: none"> • Ph.D. Thesis Topic: Reassessing the Fundamentals: On the Evolution, Ages, and Masses of Neutron Stars • Ph.D. Focus: Astrophysical Computation, Mathematical Modeling and Simulation • M.Sc. Focus: Multi-wavelength Observations • Advisor: Stephen E. Thorsett <p>Pennsylvania State University (M.Sc.); Astronomy & Astrophysics, 1999 – 2001</p> <ul style="list-style-type: none"> • Focus: Observation, Analysis and Instrumentation (in Radio and High Energy) • Advisors: Alex Wolszczan, George Pavlov, Gordon P. Garmire <p>Middle East Technical University (B.Sc.); Ankara, Turkey; Physics, 1994 – 1997</p> <ul style="list-style-type: none"> • Focus: Astronomy & Astrophysics • <i>Summa Cum Laude</i>, Advanced Physics Program, Valedictorian 	
RESEARCH INTERESTS	<p>Machine Learning & Informatics - Applications of Artificial Intelligence (Deep Learning), Applied Statistics (Bayesian), Information Theory (Divergence, Entropy), and scalable Computer Aided Learning (Deep Neural Networks) to engineering and astrophysical problems; Astrophysics - Neutron Stars, Pulsars, Mathematical Modeling of Globular Cluster Dynamics, Black Holes.</p>	
OTHER QUALIFICATIONS	<p>Project manager certified by Kepner-Tregoe; Teaching Certificate by Derek Bok Center for Teaching and Learning, Harvard University.</p>	
APPOINTMENTS	<p>Data Science Lead Principal Investigator Multi-Institutional R&D</p> <p>Astrophysicist Associate Scientist Institute for Theory & Computation Harvard-Smithsonian Center for Astrophysics</p> <p>Head/Teaching Fellow Lecturer Harvard University</p> <p>Visiting Scientist Massachusetts Institute of Technology (MIT)</p> <p>Postdoctoral Research Fellow Harvard-Smithsonian Center for Astrophysics</p> <p>Researcher Teaching Assistant University of California, Santa Cruz</p> <p>McLean Fellow Researcher University of California, Santa Cruz</p> <p>Data Analyst Consultant Space Telescope Science Institute/AURA/NASA</p> <p>Graduate Researcher Pennsylvania State University</p> <p>Fulbright Exchange Fellow in Astrophysics Pennsylvania State University</p> <p>Research/Teaching Assistant</p>	<p>2010 – 2017</p> <p>2013 – 2017</p> <p>2012 – 2017</p> <p>2012 – 2013</p> <p>2011 – 2013</p> <p>2005 – 2010</p> <p>2004 – 2005</p> <p>2001 – 2004</p> <p>2000 – 2001</p> <p>1998 – 2000</p> <p>1997 – 1998</p>

Middle East Technical University
Sonmak Fellow 1994 – 1997
 Middle East Technical University

RESEARCH &
EXPERIENCE

Machine Learning, AI & Informatics 2001 to present

- Formed, led and managed an international collaboration of 45 engineers and scientists working in 5 different organizations across 4 different countries. Successfully produced a prototype antenna assembly that merges hardware design, astrophysics, signal processing, and innovative implementations of artificial intelligence.
- Developed a new approach based on information theory that merges heterogenous data sets (i.e., optical, radio, and high-energy observational data, N-body simulations, and probabilistic modeling). This led to the discovery of an intermediate-mass black hole in publicly available data.
- Developed an analytically tractable approach in non-parametric Bayesian error estimation that can be used for data with non-Gaussian errors. This led to the discovery of the bimodal feature in the neutron star mass distribution.
- Developed a scalable neural network-based approach that can link subtle dynamical features to otherwise invisible black holes in globular clusters.
- Developed a scalable neural network based approach to infer the error distribution as an extension of classification.
- Developed a statistical model for the effects to charge pile-up in CCDs to infer the in underlying true spectral features.
- Built a database and pipeline for the **Hubble Space Telescope** (i.e., WFPC2 archival pure parallels), optimized it for mining, rebuilt the calibration database system and managed operations, coordinated pointing/guiding - performance and fine guidance sensors operations, satellite communications at the Space Telescope Science Institute.
- Developing Deep Neural Network approaches that can go beyond the standard Euclidian parametric geometry and effectively operate in complex Riemann topologies.

Multi-wavelength Observation & Instrumentation 1999 to Present

- Multi-wavelength observations and analysis of pulsars in radio, X-rays and gamma-rays; with Arecibo and Parkes radio observatories, **Chandra** X-ray observatory, and the Fermi lat gamma-ray observatory; probabilistic modeling of the **Chandra** X-ray satellite ACIS chip quantum efficiencies and electron pile-up on CCDs.

Astrophysical Theory 2006 to Present

- Theoretical modeling of millisecond pulsar formation and evolution, pulsar age estimates, neutron star mass measurements, compact binary evolution, accretion processes and geometry, globular cluster dynamics.

AWARDS &
RECOGNITIONS

Special Recognition with Proclamation by the MA House of Representatives 2017
The Harvard-Q Award, Harvard University 2015
Teaching Award, Department of Astronomy, Harvard University 2014
BIDEB Visiting Fellow, Turkey 2012, 2013, 2015
Sigma Xi Scientific Research Honor Society, Harvard University Chapter 2011
McLean Fellow, University of California, Santa Cruz 2004
Fulbright Fellow in Physics, Astronomy & Astrophysics 1998 – 2000
Valedictorian, High Honors and Distinction, Middle East Technical University 1997
Presidents Award for Academic Excellence and Achievement 1997
 Middle East Technical University
President High Honors List, Middle East Technical University 1994 –1997
Sonmak Fellowship, Middle East Technical University 1994 –1997

PROGRAMMING
SKILLS

- Main programming language: **Python** (w/ extensive use of Jupyter, Pandas, Numpy; TensorFlow, Pytorch, Keras Models for implementations of *Supervised* and *Unsupervised* Deep Learning algorithms; Scikit-learn for classification, regression, clustering, dimensionality reduction and model analysis).
- Experience with: CUDA, IDL, R, Hadoop, SQL, Shell, C, C++, and Fortran.

REFEREED
JOURNAL
PUBLICATIONS

- **Kızıltan, B.**, Baumgardt, H., Loeb, A., 2017, “An Intermediate Mass Black Hole in the Globular Cluster 47 Tucanae”, *Nature*, 542, 203.
- Eksi, Andac, Cikintioglu, Gugercinoglu, Motlagh, **Kızıltan, B.**, 2016, “Inclination Angle and Braking Index Evolution of Pulsars with Plasma-Filled Magnetosphere: Application to High Braking Index of PSR J1640–4631”, *Astrophysical Journal Letters*, 823, 34E.
- **Kızıltan, B.**, Kottas T., De Yoreo M., Thorsett S., E., 2013, “The Neutron Star Mass Distribution”, *Astrophysical Journal*, 778, 66.
- **Kızıltan, B.**, & Thorsett, S., E., 2010, “Millisecond Pulsar Ages: Implications of Binary Evolution and a Maximum Spin Limit”, *Astrophysical Journal*, 715, 335.
- Weltevrede, P.; Johnston, S.; Manchester, R. N.; Bhat, R.; Burgay, M.; Champion, D.; Hobbs, G. B.; **Kızıltan, B.**; Keith, M.; Possenti, A.; Reynolds, J. E.; Watters, K., 2010, “Pulsar Timing with the Parkes Radio Telescope for the Fermi Mission”, *Publications of the Astronomical Society of Australia (PASA)*, 27, 64.
- **Kızıltan, B.**, & Thorsett, S., E., 2009, “Constraints on Pulsar Evolution: The Joint Period–Spin down Distribution of Millisecond Pulsars”, *Astrophysical Journal Letters*, 693, L109.
- Fermi LAT Collaboration w/**Kızıltan, B.**, 2009, “Pulsed Gamma-rays from PSR J2021+3651 with the Fermi Large Area Telescope”, *Astrophysical Journal*, 700, 1059A.
- Fermi LAT Collaboration w/**Kızıltan, B.**, 2009, “Fermi LAT Observations of Vela Pulsar”, *Astrophysical Journal*, 696, 1084A.
- Fermi LAT Collaboration w/**Kızıltan, B.**, 2009, “The Fermi Gamma Ray Space Telescope discovers the Pulsar in the Young Galactic Supernova-Remnant CTA 1”, *Science*, 322, 1218A.
- Zhang, C. M.; Yin, H. X.; Kojima, Y.; Chang, H. K.; Xu, R. X.; Li, X. D.; Zhang, B.; **Kızıltan, B.**, 2006, “Measuring Neutron Star Mass and Radius with Three Mass - Radius Relations”, *Monthly Notices of the Royal Astronomical Society*, Volume 374, Issue 1, pp. 232–236.
- Wadadekar, Yogesh; Casertano, Stefano; Hook, Richard; **Kızıltan, Bülent**; Koekemoer, Anton; Ferguson, Henry; Denchev, Doichin, 2006, “The WFPC2 Archival Pure Parallels Project”, *Publications of the Astronomical Society of Pacific (PASP)*, Volume 118, Issue 841, pp. 450–460.
- Pavlov, George G.; Sanwal, Divas; **Kızıltan, Bülent**; Garmire, Gordon P., 2001, “The Compact Central Object in the RX J0852.0–4622 Supernova Remnant”, *Astrophysical Journal Letters*, 559, L131–134.

CONFERENCE
PROCEEDINGS,
ABSTRACTS AND
OTHER

- Probing Relics of Galaxy Formation with Cosmic Clocks: Pulsars in Globular Clusters, American Astronomical Society, AAS Meeting #224, Boston, 2014
- The Pulsar Quartet: Listening to a Galactic Symphony, American Astronomical Society, AAS Meeting #224, Boston, 2014
- **Kızıltan, B.**, Kottas T., Thorsett S., E., 2011, “The Neutron Star Mass Distribution”, arXiv: 1011.4291 (1st version of the paper later published in *Astrophysical Journal*, 778, 66, 2013)
- Reassessing the fundamentals: New Constraints on the Evolution, Masses and Ages of

Neutron Stars, Astrophysics of neutron stars conference proceedings, AIP publishing (2011), ArXiv: 1102.5094

- Putting Neutron Stars On A New Scale: The Underlying Mass Distribution of Pulsars from Radio Observation, 215th American Astronomical Meeting, #300.089 (2010)
- Redefining Millisecond Pulsar Ages, 214th AAS Meeting, Vol. 41, p.699 (+Press conference) (2009)
- Constraints on Millisecond Pulsar Evolution, 213th AAS Meeting, 213–L–2291 (2009)
- Do all millisecond pulsars share a common heritage?, NSBP/NSHP Conference, AIP publishing (2009)
- Connecting the Current with the Past: The Spin? Down Evolution of Millisecond Pulsars, 40 Years of Pulsars: Millisecond Pulsars, Magnetars and More. AIP Conference Proceedings, Volume 983, pp. 639–641 (2008)
- Neutron Star Physics in the GLAST Era, 40 Years of Pulsars: Millisecond Pulsars, Magnetars and More., AIP Conference Proceedings, Volume 983, pp. 639–641 (2008)
- The Distribution of Ages, Magnetic Fields and Spin Period Periods of Millisecond Pulsars, 209th AAS Meeting, Vol. 38, p.1065 (2007)
- Pulsar Mass Measurements, Texas in Australia: XXIII Meeting on Relativistic Astrophysics (2006)
- Pulsar Physics with GLAST, Texas in Australia: XXIII Meeting on Relativistic Astrophysics (2006)
- Neutron Star Physics with GLAST, 36th COSPAR Scientific Assembly Meeting: Plenary Meeting, 2114 (2006)
- The Distribution of Magnetic Fields, Ages and Spin Periods of Millisecond Pulsars, 36th COSPAR Scientific Assembly: Plenary Meeting, 2155 (2006)
- Pulsar Astronomy with GLAST, Heraeus Meeting: Neutron Star, Pulsars & Supernova Remnants (2006)
- Pulsar Mass Measurements, Heraeus Meeting: Neutron Star, Pulsars & Supernova Remnants (2006)
- The Distribution of Ages, Magnetic Fields and Spin Period Periods of Millisecond Pulsars, Heraeus Meeting: Neutron Star, Pulsars & Supernova Remnants (2006)
- Pulsar Astronomy with GLAST, A Life with Stars, (New Astronomy Reviews, Elsevier), eds. Kasper, Van der Klis, Wijers (2005)
- Pulsar Mass Measurements, A Life with Stars, (New Astronomy Reviews, Elsevier), eds. Kasper, Van der Klis, Wijers (2005)
- Neutron Star Physics with GLAST, Neutron Stars at Crossroads meeting (2005)
- Pulsar Mass Measurements, Neutron Stars at Crossroads meeting (2005)
- Using Multidrizzle to Combine Dithered WFPC2 Images, Brammer, G.; Koekemoer, A. M., **Kızıltan, B.**, HST Calibration Workshop, p. 235 (2002)
- Exploring the Central Region of SNR RX J0852.0–4622 and a Search for an Optical Counterpart, ASP Conference Series; eds. P. O. Slane, B. M. Gaensler, Vol. 271, 293 (2002)

BOOKS

- Reassessing the Fundamentals: New Constraints on the Evolution, Masses and Ages of Neutron Stars, Bülent Kızıltan, Ph.D. Thesis, 2011, Universal Publishers, ISBN: 1612337651

SELECTED PRESENTATIONS

- Center for Relativistic Astrophysics (CRA) Seminar, Georgia Tech, Atlanta 4/2017
- Exploring the Astronomical Discovery Space with Deep Learning - Discovery in the Era of Astronomically Big Data Conference, STScI 2/2017
- Black Hole Initiative Colloquium, Cambridge 1/2017
- The Intricate Dynamical Relation of Compact Objects in Globular Clusters, Harvard-Smithsonian Center for Astrophysics 11/2016
- A Case for Computer Aided Learning: Probing Globular Clusters with Gravity,

- Smithsonian Observatory 8/2016
- Lightbox Gallery Talk: Pulsar Sounds and Symphony, Harvard Art Museum 3/2016
- Zooming into Globular Clusters with Pulsars, Harvard-CfA 12/2014
- The Pulsar Quartet: Listening to a Galactic Symphony, American Astronomical Society Meeting #224, Boston 6/2014
- Probing Relics of Galaxy Formation with Cosmic Clocks: Pulsars in Globular Clusters, American Astronomical Society Meeting #224, Boston 6/2014
- Probing Fundamentals in Physics and Astronomy with Neutron Stars, Physics Department Colloquium, Bosphorus University 11/2013
- The Most Exotic Objects in the Universe (Uzayın En Egzotik Cisimleri), Physics Department Colloquium, Yildiz Technical University 10/2013
- Neutron Stars: Probing Fundamentals with Fundamentals, Physics Department Colloquium, Middle East Technical University 5/2013
- Globular Cluster Dynamics: Probing Globular Clusters with Pulsars Physical Applications of Millisecond Pulsars, Aspen Center for Physics 1/2013
- **TEDx** talk on "Our Connection to the Cosmos", TEDxFulbright, Cambridge 4/2012
- Beyond the tip of the iceberg: Predicting the bulk properties of the neutron star population, Ohio State University, Department of Astronomy 1/2012
- Beyond the tip of the iceberg: Predicting the bulk properties of the neutron star population, Colloquium, Yale University, Department of Astronomy 12/2011
- Pulsars as Tools for Fundamental Physics, Astrophysics Seminar, Brown University, Department of Physics 5/2011
- Millisecond Pulsar Evolution: An incomplete jigsaw puzzle, Institute for Theory and Computation (ITC), Harvard-CfA 3/2011

TEACHING &
MENTORING
EXPERIENCE

- Head Teaching Fellow 1/2017 – 6/2017
Science of the Physical Universe: The Unity of Science (SPU 22), Undergraduate course w/ Prof. Irwin Shapiro, Harvard College
- Teaching Fellow 10/2016 – 12/2016
Quantum Mechanics for Astrophysics (Astron 251), Graduate course w/ Prof. Lars Hernquist, Department of Astronomy, Harvard University
- Teaching Fellow 1/2015 – 6/2015
Science of the Physical Universe: The Energetic Universe (SPU 19), Undergraduate course w/ Prof. Robert Kirshner, Harvard College
- Teaching Certificate 5/2014
Derek Bok Center for Teaching and Learning, Harvard University
- Teaching Fellow 1/2014 – 6/2014
Science of the Physical Universe: The Unity of Science (SPU 22), Undergraduate course w/ Prof. Irwin Shapiro, Harvard College
- Teaching Certificate Program 2/2013
The Physical Voice: Vocal Performance Techniques for Scholars, Derek Bok Center for Teaching and Learning, Teaching Certificate Program, Harvard University
- Teaching Certificate Program 5/2012
Public Speaking Techniques, Derek Bok Center for Teaching and Learning, Teaching Certificate Program, Harvard University
- Teaching Certificate Program 1/2012
Focus on Advanced Teaching and Communication, Derek Bok Center for Teaching and Learning, Teaching Certificate Program, Harvard University
- Teaching Fellow 1/2012 – 6/2012
High Energy Astrophysics (Astron 219), Graduate course w/ Prof. Ramesh Narayan, Prof. Edo Berger; Department of Astronomy, Harvard University
- Teaching Fellow 1/2012 – 6/2012
Science of the Physical Universe: Life as a Planetary Phenomenon (SPU 30), Undergraduate course w/ Prof. Dimitar Sasselov; Harvard College

Teaching Assistant	9/2010 – 12/2010
Mechanics, University of California, Santa Cruz	
Mentor Czar	9/2008 – 9/2010
Founder of the Peer Mentoring Program, Department of Astronomy and Astrophysics, University of California, Santa Cruz	
Lecturer/Seminar Organizer	9/2006 – 11/2006
Physics of Compact Objects, University of California, Santa Cruz	
Teaching Assistant	9/2004 – 12/2004
Planets and Planetary Systems, University of California, Santa Cruz	