JAM SADIQ

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Instituto Galego de Fisica de Altas Enerxias - IGFAE, ◇ University of Santiago de Compostela, 15705

EDUCATION AND EMPLOYMENT

Postdoctoral Researcher *October 2020 -*
University of Santiago de Compostela, Spain
Instituto Galego de Fisica de Altas Enerxias - IGFAE, USC

Assistant Professor in Mathematics *September 2019 - August 2020*
Sukkur IBA University, Sukkur, Sindh, Pakistan
Department of Mathematics and Social Sciences
Courses: General Relativity, Quantum Mechanics, Computational Physics, Introductory Astrophysics

PhD in Astrophysics: Fulbright PhD Fellow *August 2014 - August 2019*
Rochester Institute of Technology, Rochester, NY, 14623
Center for Computational Relativity and Gravitation

Lecturer in Mathematics *May 2013 - August 2013*
University of Engineering and Technology Taxila sub campus Chakwal, Pakistan
Courses: Linear Algebra, Differential Equations

Masters of Philosophy (M.Phil) in Mathematics *August 2010 - September 2012*
Quaid-i-Azam University, Islamabad, Pakistan
Department of Mathematics

Master of Science (M.Sc) in Mathematics *January 2008 - January 2010*
Quaid-i-Azam University, Islamabad, Pakistan
Department of Mathematics

TECHNICAL STRENGTHS

Software	PyCBC, Einstein Toolkit, VisIt, Mathematica, GWpy, Scikit-learn RIFT, Maple, LaTeX, Git, SageMath
Programing Languages	Python, C/C++, R
Operating System	Fedora/CentosOS Linux, Mac OS, Windows 10

GRANTS AND FELLOWSHIPS

Postdoctoral Fellowship *October 2020 -*
Postdoctoral Research Fellowship at IGFAE under the grant by Xunta de Galicia, at USC, Spain

Fulbright PhD Fellowship *August 2014 - August 2019*
Fulbright PhD Fellowship by US state department for five years which covered the entire cost of my PhD in the US.

Japanese need based Scholarship *January 2009*
Awarded for being a talented and deserving student
Quaid-i-Azam University, Islamabad

PROJECTS

Studying the limitations of approximate analytic spacetimes for binary black holes
In this project I developed a new technique to compare analytical spacetime evolution versus their counterpart in numerical relativity evolution using gauge-independent quantities related to geodesic deviation. Our method can help improve analytical approximate models that have been used to study the dynamics of accretion disks around supermassive black hole binaries.

Hybrid waveforms for generic precessing binaries for gravitational-wave data analysis
We construct hybrid binary black hole merger waveforms, using analytical model waveforms for the early inspiral phase and numerical relativity waveforms for late inspiral to merger and post-merger phases. Our goal is to hybridize waveforms for more generic precessing binaries and construct longer waveforms that are sufficiently accurate for performing parameter estimation on signals detected in upcoming LIGO-Virgo observations.

Flexible and fast estimation to infer population properties binary merger population distributions using with adaptive KDE
Using a fast and flexible Kernel density estimator (KDE) we reconstruct the mass distribution of LIGO-Virgo binary mergers from parameter estimation outputs and our results are comparable with existing Bayesian hierarchical models, which assume a specific form of distribution and are more computationally intensive.

LIGO collaboration contributions
I am also involved on **automation and improvement of PyGRB search pipeline** for detections of gravitational waves from observed data and associated Gamma Ray Bursts (GRBs) observations. I have contributed to data analysis and reviews work within LIGO/Virgo scientific collaboration.

CONFERENCES

GRavitational-waves Science & technology Symposium (GRASS) 2022 June 6-7,2022; Padova, Italy
Poster: Flexible and Fast Estimation of Binary Merger Population Distributions with Adaptive KDE

GWPAW 2021 December 14-17, 2021; Hannover, Germany
Poster: Flexible and Fast Estimation of Binary Merger Population Distributions with Adaptive KDE

(Online) Amaldi14 conference on gravitational waves., July 19-23, 2021
Poster: Flexible and Fast Estimation of Binary Merger Population Distributions with Adaptive KDE

(Online) 11th Iberian Gravitational Waves Meeting, June 9-11, 2021
Talk: Hybrid Waveforms for Precessing Binary Black holes for LIGO Data Analysis

3rd International Conference on Computing, Mathematics and Engineering Technologies (iCoMET), January 29-30, 2020; Sukkur, Sindh, Pakistan
Talk: Waveform template bank for Precessing binary black holes for detection of gravitational waves

APS April Meeting April 13-16, 2019; Denver, Colorado, USA
Talk: Hybrid Wave-forms for Precessing binary black holes for LIGO data analysis

APS April Meeting April 14-17, 2018; Columbus, Ohio, USA
Talk: A new tool to check the accuracy of Analytic Spacetimes for binary black holes

27th Midwest Relativity Meeting, October 12-14, 2017, Ann Arbor, MI, USA
Talk: Comparing Spacetimes using Geometric Scalars

21st International Conference on General Relativity and Gravitation, Columbia University July 10-15, 2016, New York, USA
Talk: Comparing Space-time using Geometric Scalars

WORKSHOPS

European Einstein Toolkit School 2022, 29 August - 2 September, 2022
University College Dublin, Dublin, Ireland

(Online) Summer School in Statistics for Astronomers XVI, June 1–5, 2021
The Pennsylvania State University, USA

(Online) Current challenges in gravitational physics workshop, April 21-28, 2021
Sissa, Italy

(Online) Statistical Methods for the Detection, Classification, and Inference of Relativistic Objects November 16-20, 2020
Brown University in Providence, Rhode Island, USA

Computational Challenges in Gravitational Wave Astronomy, Jan 28 - Feb 1, 2019
University of California, Los Angeles (UCLA), CA, USA

North American Einstein Toolkit School and Workshop NCSA, July 31 - August 4, 2017
University of Illinois at Urbana Champaign, IL, USA

The Astrophysical Black Hole Merger Workshop VI, June 21-22, 2016
Organizing committee member
Center for Computational Relativity and Gravitation, RIT, Rochester, NY, USA

Caltech Gravitational Wave Astrophysics School 2015, July 6-10, 2015
California Institute of Technology, CA, USA

MENTORING AND TEACHING EXPERIENCE

Zainab Mangi, Komal Naz, Kaneez Fatima (Sukkur IBA University), **supervised undergraduate final year research projects** on black hole physics, 2019-2020

Anum Zulfiqar and Farah Naz Master's thesis (Institute of Space Technology, Islamabad, Pakistan), **external committee member** for thesis on topics of "N-Body dynamics around supermassive blackhole binaries", 2020

Ifra Hassan, Nilo Cher, **co-advised, undergraduate students in summer program** at RIT on visualising two and three body Newtonian dynamics, 2018

Taught courses on **general relativity, quantum mechanics and computational physics** to advanced undergraduate students at Sukkur IBA University, 2019-2020.

Part of **Scientific Computing group meetings** at Rochester Institute of Technology to **help undergraduate students to learn computational skills**, 2018-2019.

Teaching Assistant at Rochester Institute of Technology, USA to help undergrad students in problem solving and homework in the subjects of classical mechanics and computational astrophysics, 2014-2015.

PUBLIC OUTREACH

Public lecture on Astronomy and Stephen Hawking contributions to cosmology at Sukkur IBA University, Sukkur, Pakistan, 2019

Proposal presentation to Chief Minister on funds **for opening a Planetarium** in Sukkur, Pakistan,2019

Volunteer **World Science Festival** and served as **Science Ambassador for City of Science** event, New York, USA, 2017-2018.

Tutor **for Solar Eclipse** event RIT, Rochester, NY, 2018

Member of Astronomy Section Rochester Academy of Science (ASRAS) and took part in public outreach events 2016-2018

REFERENCES

Yosef Zlochower, Ph.D. adviser
Rochester Institute of Technology
Associate Professor
yrzsma@rit.edu

Richard O'Shaughnessy
Rochester Institute of Technology
Assistant Professor
rossma@rit.edu

Thomas Dent, Postdoc mentor
University of Santiago de Compostela
Research Scientist
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Jaime Alvarez Muniz
University of Santiago de Compostela
Associate Professor
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PUBLICATION DETAILS

A. SELECTED SENIOR-AUTHOR PUBLICATIONS

1. Flexible and Fast Estimation of Binary Merger Population Distributions with Adaptive KDE
   Jam Sadiq, Thomas Dent, Daniel Wysocki, **Phys.Rev.D105 (2022) 12, 123014**, arXiv e-Print 2112.12659
   DOI: https://journals.aps.org/prd/abstract/10.1103/PhysRevD.105.123014

2. Hybrid waveforms for generic precessing binaries for gravitational-wave data analysis
   Jam Sadiq, Yosef Zlochower, Richard O'Shaughnessy, Jacob Lange, **Phys.Rev.D102 (2020) 2, 024012**, arXiv e-Print 2001.07109
   DOI: https://doi.org/10.1103/PhysRevD.102.024012

3. Comparing an analytical spacetime metric for a merging binary to a fully nonlinear numerical evolution using curvature scalars
   Jam Sadiq, Yosef Zlochower, Hiroyuki Nakano, **Phys.Rev.D97 (2018), 084007**, arXiv e-Print 1802.02990 [gr-qc]
   DOI: https://doi.org/10.1103/PhysRevD.97.084007

B. COLLABORATION PUBLICATIONS

These are some of my LIGO and Virgo scientific collaboration publication that I contributed.

1. Measurement of general-relativistic precession in a black-hole binary
   VIRGO Collaboration, arXiv e-Print:2112.11300 [gr-qc]

2. Search for Gravitational Waves Associated with Gamma-Ray Bursts Detected by Fermi and Swift During the LIGO-Virgo Run O3b
   LIGO Scientific and Virgo Collaborations, R. Abbott(LIGO Lab., Caltech) et al., arXiv e-Print 2111.03608 [astro-ph.HE]

3. The population of merging compact binaries inferred using gravitational waves through GWTC-3
   LIGO Scientific and Virgo Collaborations, R. Abbott(LIGO Lab., Caltech) et al., arXiv e-Print 2111.03634 [astro-ph.HE]

4. GWTC-2: Compact Binary Coalescences Observed by LIGO and Virgo During the First Half of the Third Observing Run
   LIGO Scientific and Virgo Collaborations, R. Abbott(LIGO Lab., Caltech) et al. **Phys.Rev.X.11 (2021) 021053**, arXiv e-Print 2010.14527 [gr-qc]
   DOI: https://doi.org/10.1103/PhysRevX.11.021053

5. All-sky search in early O3 LIGO data for continuous gravitational-wave signals from unknown neutron stars in binary systems
   LIGO Scientific and Virgo Collaborations, R. Abbott(LIGO Lab., Caltech) et al., **Phys.Rev.D 103 (2021) 6, 064017**, arXiv e-Print 2012.12128 [gr-qc]
   DOI: 10.1103/PhysRevD.103.064017

6. Search for intermediate mass black hole binaries in the third observing run of Advanced LIGO and Advanced Virgo
   LIGO Scientific and Virgo Collaborations, R. Abbott(LIGO Lab., Caltech) et al., arXiv e-Print 2105.15120 [astro-ph.HE],
   https://arxiv.org/abs/2105.15120

7. Search for Gravitational Waves Associated with Gamma-Ray Bursts Detected by Fermi and Swift During the LIGO-Virgo Run O3a
   LIGO Scientific and Virgo Collaborations, R. Abbott(LIGO Lab., Caltech) et al., arXiv e-Print 2010.14550 [astro-ph.HE] **submitted in ApJ**
   https://arxiv.org/abs/2010.14550