Nesar S Ramachandra

Contact Information

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Education

The University of Kansas, Lawrence, KS. **2013 - Present**

Candidate for Doctor of Philosophy in Physics.
- Adviser: Professor Sergei Shandarin
- GPA: 4.00/4.00

Birla Institute of Technology and Science (BITS) Pilani, India. **2008 - 2012**

Integrated Master of Science (Hons.) in Physics.
- Thesis title: Dynamics of ellipsoidal collapse in a cosmological setting
- Adviser: Professor Arun Mangalam
- Cumulative GPA: 7.75/10

Selected Research Experience

Large scale structures in the Cosmic web. **2013 - Present**

Doctoral research, The University of Kansas, Lawrence, KS.
- Formation and properties of cosmic voids, dark matter haloes, caustic surfaces
- Studies using novel cosmic fields emerging from Lagrangian to Eulerian mapping such as multi-stream field, Flip-Flop of dark matter particles, displacement fields etc.
- Analysis of topological and geometrical features of the dark matter distribution in a multi-stream environment.

Machine learning applications in Astrophysical studies. **2017 - Present**

Summer research at Argonne National Laboratory, Chicago.
- Deep Neural Networks trained on simulation images were implemented to analyze galaxy-galaxy strong lensing images.
- Project can be accessed here: github.com/hep-cce/ml_classification_studies

Emulation of Cosmological functions. **2016 - Present**

Based on a series of workshops at the Statistical and Applied Mathematical Sciences Institute (SAMSI), Research Triangle Park, North Carolina.
- Developed a fast Gaussian Process Emulator as a predictor for the Dark matter halo mass function, replacing expensive cosmological numerical simulations.

Evolution of cosmic density perturbations **2011 - 2013**

Master's thesis research at the Indian Institute of Astrophysics, Bangalore
- Analysis of non-linear perturbation theory resulting in formation of structure. The evolution of inhomogeneities using analytical models of spherical and ellipsoidal collapse are compared.

Quantum fields in non-Minkowski spaces. **2011 - 2012**

Supervisor: Professor Arun V. Kulkarni, Department of Physics, BITS-Pilani

- Investigation of conformal transformations and Penrose diagrams. Departure from the Minkowskian metric is treated as a perturbation for derivation of general solution for quantization.

Publications

Nesar Ramachandra, Sergei Shandarin *Multi-stream portrait of the Cosmic web*, Monthly Notices of the Royal Astronomical Society, Volume 452, Issue 2, p.1643-1653. (2015)

Nesar Ramachandra, Sergei Shandarin *Topology and geometry of the dark matter web: a multistream view*, Monthly Notices of the Royal Astronomical Society, Volume 467, Issue 2, p.1748-1762. (2017)

Nesar Ramachandra, Sergei Shandarin *Dark matter haloes: a multistream view*, Monthly Notices of the Royal Astronomical Society. Volume 470, Issue 3, p. 3359-3373. (2017)

Noam Libeskind, Rien van de Weygaert, Marius Cautun, *et al.* (incl. **Nesar Ramachandra**), *Tracing the cosmic web*, Monthly Notices of the Royal Astronomical Society, Volume 473, Issue 1, Pages 1195-1217 (2018)

Selected talks

Deep learning pipelines for lensing analysis, Astrophysics Seminar, University of Kansas. **September 2017**

Strong Lensing analysis using Deep Neural Networks, Young Scientists Symposium, Argonne National Laboratory. **July 2017**

Emulation of the halo mass function, SAMSI, Research Triangle Park, North Carolina. **April 2017**

Cosmic structures, Particle Physics Journal Club, The University of Kansas. **March 2017**

Topology and geometry of the dark matter web, American Physical Society April Meeting 2017 at Washington D.C. **January 2017**

Halo Sub-structures from Flip-flop Fields, Astrophysics, Space & Plasma Astrophysics Seminar, The University of Kansas. **November 2016**

Topology and geometry of the dark matter web, Comprehensive presentation, Department of Physics and Astronomy, The University of Kansas. **September 2016**

The Multi-stream portrait of the cosmic web, American Physical Society April Meeting 2016 at Salt Lake City, Utah. **April 2016**

Poster presentation: **Components of the Dark matter Universe**, Graduate Research competition at The University of Kansas.	**March 2016**
The Multi-stream portrait of the cosmic web, Canadian-American-Mexican Graduate Students Physics Conference (CAM 2015) at Oaxaca, Oaxaca, Mexico.	**September 2015**
Dark matter halo statistics, Astrophysics, Space & Plasma Astrophysics Seminar, The University of Kansas.	**April 2015**
Poster presentation: **The dynamical structure of the cosmic web**, MidAmerican Regional Astrophysics Conference (MARAC 2015) at The University of Missouri.	**April 2015**
Poster presentation: **The dynamical structure of the cosmic web**, Graduate Research competition at The University of Kansas.	**April 2015**
Multi-Stream Portrait of the Cosmic Web, Astrophysics, Space & Plasma Astrophysics Seminar, The University of Kansas.	**December 2014**
Dynamics of the Cosmic Web, Astrophysics, Space & Plasma Astrophysics Seminar, The University of Kansas.	**April 2014**
Evolution of density perturbations in a Cosmological context, Masters thesis defense at the Indian Institute of Astrophysics, Bangalore.	**February 2013**
Dynamics of ellipsoidal collapse, Visiting internship students' seminar, Indian Institute of Astrophysics, Bangalore.	**May 2012**

Workshops

Machine Learning @ Argonne National Laboratory, Argonne Leadership Computational Facility, Chicago.	**July 2017**
Scaling to Petascale Institute, Argonne National Laboratories, Chicago.	**June 2017**
Frontier Topics of Large-scale Predictive Analytics, Lawrence, Kansas.	**June 2017**
ASTRO: Transition workshop on statistical methods in Astronomy, SAMSI, Research Triangle Park, North Carolina.	**May 2017**
Astrophysical Population Emulation and Uncertainty Quantification, SAMSI, Research Triangle Park, North Carolina.	**April 2017**
ASTRO: Opening workshop, SAMSI, Research Triangle Park, North Carolina.	**August 2016**
Summer School in Physics and Astrophysics, Indian Institute of Astrophysics, Kodaikanal, India	**May 2011**

School on theoretical high energy physics, Science and Engineering Research Council (SERC), Goa, India. **October 2010**

Academic experience

Summer internship under supervision of Prof. Salman Habib and Dr. Taylor Childers, Cosmological Physics and Advanced Computing (CPAC) Group, Argonne National Laboratory, Chicago. **2017**

Graduate Research Assistant under the supervision of Prof. Sergei Shandarin, The University of Kansas. **2013 - present**

Head Graduate Teaching Assistant, Department of Physics and Astronomy, The University of Kansas. **2015 - 2016**

Graduate Teaching Assistant - College Physics 1 (PHSX 114), General Physics (PHSX 214 and 216) at The University of Kansas. **2014 - 2015**

Research Scholar at the Tata Institute of Fundamental Research - Centre for Interdisciplinary Science, Hyderabad, India **2013**

Visiting Research scholar at the Indian Institute of Astrophysics, Bangalore, India **2012-2013**

Undergraduate Teaching Assistant, Theory of relativity (PHY C242) at BITS-Pilani, Goa. **2011**

Computer skills

Programming Languages: Python (numpy, scipy, mpi4py, pandas, matplotlib, mayavi, scikit-learn, TensorFlow, Keras), C/C++ (with MPI and CUDA), Fortran, R

Softwares: Mathematica, ParaView, MeshLab

Publishing: LaTeX

Awards, Grants and Fellowships

High Energy Physics - Center for Computational Excellence summer fellowship. **June 2017**

Travel grant by the Statistical and Applied Mathematical Sciences Institute for the Astrophysical population emulation workshop. **April 2017**

Graduate Research travel award from the University of Kansas for the American Physical Society- April 2017 meeting. **January 2017**

Travel grant by the Statistical and Applied Mathematical Sciences Institute for ASTRO opening workshop. **August 2016**

Travel grant from Divison of Astrophysics, American Physical Society for the Americal Physical Society- April 2016 meeting. **April 2016**

Graduate Research Competition Award for the 2015-16 academic year by the University of Kansas.	**April 2016**
Combined Travel grant by the National Science Foundation, the American Physical Society and the Sociedad Mexicana de Fisica for the CAM conference.	**September 2015**
Junior research fellowship in Physics from the Council for Scientific and Industrial Research, Government of India.	**October 2012**
INSPIRE (Innovation in Science Pursuit for Inspired Research) scholarship from the Department of Science and Technology, Government of India.	**2008 - 2012**

Professional service and activities

Referee, Journal of Cosmology and Astroparticle Physics, IOP Publishing.	**2016 - Present**
President, Society of Physics Students, The University of Kansas chapter.	**2015 - Present**
Member, KUbeSat team - a University of Kansas miniature satellite Mission. Our Cosmic Ray Detector design through SPS won the Chapter Research Award by American Institute of Physics.	**2016 - Present**
Member, American Physical Society (APS)	**2014 - Present**
Chief Organizer, TEDxBITSGoa conference, India.	**February 2011**
