Nirmal Raj

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https://sites.google.com/view/nirmal-raj
PhysicsNirmal

Assistant Professor, IISc

Employment

03/2023–present **Assistant Professor**, *Indian Institute of Science*.

01/2023–03/2023 **Postdoctoral Research Associate**, *Arthur B. McDonald Canadian Astroparticle Physics Research Institute, Queen's University*, Canada.

2018–22 **Postdoctoral Researcher - Theory**, *TRIUMF*, Canada.

2015–18 **Postdoctoral Research Associate**, *University of Notre Dame*, USA.

Education

2009–15 **PhD in Physics**, *University of Oregon*, USA.
Advisor: Graham D. Kribs
Thesis: *Dark Matter and Supersymmetry in the LHC Era*

2005–09 **BTech in Engg. Physics**, *Indian Institute of Technology Madras*, India.
Advisor: Rajesh Narayanan
Thesis: *Phase Transitions and the Renormalization Group*

Teaching

NPTEL

Spring 2025 **Particle Physics and the Standard Model**, *NPTEL*, instructor.

IISc

Fall 2023, 2024 **HE/PH 215: Nuclear and Particle Physics**, *CHEP, IISc*, instructor.

TRIUMF

June 2020 **Certified CIRTL Associate**, *via Instructional Skills Workshop*, University of British Columbia.

2019–21 **Undergraduate Lecture Series**, *TRIUMF*, Lectures on Dark Matter.

Oregon

2009–15 **Graduate Teaching Fellow**, *University of Oregon*.
Quantum Field Theory (2013-15): PHYS 634, 665, 666
Quantum Physics (2010-13): PHYS 414, 415, 416
Astrophysics (2009-10): PHYS 123
General Physics (2009-10): PHYS 201, 202, 203

2009-15 **Private tutoring**.
about 20 undergraduate & 2 high school students

Outreach

05/2024-present **ThePrint**, *layperson articles on fundamental physics*.

08/2023-present **The Hindu**, *ditto*.

09/2025 **Fundamental Physics and CHEP**, *talk and organization of visit by Masters students from Central University of Karnataka*.

07/2025 **The Scientific Virtues Project, Michigan State University**, *interview on evolving scientific ethics*.

05/2025 **IISc Agastya Science Enrichment Program 2025**, *lectures to high school students on fundamental forces and dark matter*.

03/2025 **Ensemble**, *interview by Intra-IISc physics newsletter*.

02/2025 **Beyond the Science**, *podcast by Office of Communications, IISc.*

01/2025 **My favourite paper**, *invited article in Entangled, newsletter of Phi Delta Alpha student committee, IISc.*

07/2024 **The Hindu**, *quoted in 'Why are scientists looking for the Higgs boson's closest friend?' by Vasudevan Mukunth.*

06/2024 **IISc webpage**, *Turning telescopes into thermometers for neutron stars.*
Broad audience write-up on research paper featured on IISc and PRD home pages.

06/2024 **Connect Magazine**, *quoted in 'Scientists on Sci-fi' by Sandeep Menon.*

12/2023 **Emergence**, *podcast with G. V. Pavan Kumar, IISER Pune.*

07/2023 **Around Academia in an Afternoon**, *interview with Quarks, IISc undergraduate magazine.*

2021–22 **Leaning Out of Windows**.
Interdisciplinary project in collaboration with artists at Emily Carr University, Vancouver, BC, on theme *Invisible Forces*, interpreted to highlight historically under-represented peoples.

2019–20 **Letters to a Pre-Scientist**.
Pen pal program involving middle school students, with goal of encouraging them to overcome socioeconomic and psychological barriers to pursue a career in STEM.

2021–23 **Particle Bites**, *contributing author.*
Online journal club.

2019 **Dark Matter Day**.
Public interview with TRIUMF Strategic Communications.

Twitter.
Physics explanations for non-experts.

Academic duties

Community planning

Snowmass 2021 **Co-ordinator**, *white paper on "Ultra-heavy particle dark matter".*

Contributor, *white paper on "Dark matter in extreme astrophysical environments".*

Contributor, *"Report of the Topical Group on Particle Dark Matter for Snowmass 2021".*

Future experiments **Contributor**, *white paper on "A Next-Generation Liquid Xenon Observatory for Dark Matter and Neutrino Physics".*

Contributor, *white paper on "SNEWS 2.0: A Next-Generation SuperNova Early Warning System for Multi-messenger Astronomy".*

Letters of interest

Snowmass 2021 **Multi-scattering dark matter at neutrino experiments**.

Supernova neutrinos and particle physics opportunities.

Organization

Quarks Magazine at IISc

12/2023-present **Faculty advisor**.

Centre for High Energy Physics at IISc

09/2025–present **CHEP Weekly Internal Seminar**, *CHEP, IISc*, organizer.

08/2024 **Frontiers in Particle Physics conference**, *CHEP, IISc*, member.

02/2024 **Open Day committee**, *CHEP, IISc*, member.

10/2023-11/2023 **In-House Symposium committee**, *CHEP, IISc*, member.

07/2023-present **Library committee**, *CHEP, IISc*, Chair.

08/2023-present **Department Curriculum committee**, *CHEP, IISc*, member.

05/2023-present **PhD interview committee**, *CHEP, IISc*, member.

04/2023-present **Website committee**, *CHEP, IISc*, member.

04/2023-present **Social media committee**, *CHEP, IISc*, member.

TRIUMF

2019–22 **Theory Seminar**, *TRIUMF*.

2020–22 **Dark Matter Forum**, *TRIUMF*.
Monthly meetings bringing together theorists and experimentalists working on the dark matter problem.

2018–21 **Theory Workshop**, *TRIUMF*, co-organizer.

2020–21 **Theory Group Meeting**, *TRIUMF*.

Notre Dame

2017–18 **Theory Seminar**, *University of Notre Dame*.

Journal referee

2015–present **Physical Review Letters (PRL)**.

2015–present **Physics Review D (PRD)**.

2024–present **Journal of Cosmology and Astrophysics (JCAP)**.

2024–present **The Astrophysical Journal (ApJ)**.

2023–present **Journal of High Energy Physics (JHEP)**.

2018–present **Physics of the Dark Universe**.

2021–present **European Physics Journal C**.

2025–present **European Physics Journal Special Topics**.

Conference chair

2021/05 **PHENO 2021**, *Pittsburgh, PA*, parallel talk session.

2021/05 **PPC 2021**, *University of Oklahoma, Norman, OK*, parallel talk session.

2016/11 **Higgs Couplings 2016**, *SLAC National Laboratory, Menlo Park, CA*.

Collaborations

2020–present **SuperNova Early Warning System (SNEWS)**.

2019–21 **Dark Matter Experiment Using Argon Pulse-Shape Discrimination (DEAP)**.
Member of working group on direct search for multi-scattering dark matter.

Awards

2020/08 **Best Research Presentation**, *McDonald Institute National Meeting*, VirBELA.

2017/07 **Winner, talk promotion video contest**, *TeVPA 2017*, Columbus, OH.

Languages

schooling **English**.

native fluency **Tamil, Marathi, Telugu**.

Talks

Slides available at http://nirmalraj.wikidot.com/talks

Invited public talks

Kolar Neutrinos

2025/03 **Science Gallery Bengaluru**, *Public lecture on neutrinos and the experiments at KGF*.

Vignana Adda

2025/03 **Indian Institute of Science**, *Open Day panel on public interaction*.

In Search of Gold

2025/02 **Science Gallery Bengaluru**, *panel at Bangalore International Centre on Kolar Gold Field experiments with docu-maker Basav Biradar and physicist Palahalli Vishwanath*.

Six Ways Dark Matter Can Kill You

2024/03 **Indian Institute of Science**, *Astronomy Club*.

The Enigma of Dark Matter

2023/02 **Physics Frontiers**, *forum at Chennai, India*, lecture in Tamil.

On Collaboration

2022/04 **Emily Carr University of Art + Design**, *Vancouver, BC*, at Swiss-Canadian Innovation Fest.

Invited colloquiums

Dark Fires in the Sky: Compact Stars as Dark Matter Calorimeters

2024/03 **Tata Institute of Fundamental Research**, *Mumbai, India*, Wednesday Colloquium.

The Reverse Rutherford Era of Dark Matter

2023/02 **Indian Institute of Technology Bombay**, *Mumbai*.

2022/12 **Tata Institute of Fundamental Research**, *Hyderabad, India*.

2022/09 **Institute of Mathematical Sciences**, *Chennai*, virtual talk.

2022/01 **Indian Institute of Science**, *Bengaluru*.

2021/04 **Indian Institute of Technology Madras**, *Chennai*, virtual talk.

2021/02 **Instituto Nazionale di Fisica Nucleare (INFN)**, *Cagliari, Italy*, virtual talk.

2020/09 **TRIUMF**, *Vancouver, BC*.

2019/03 **Carleton University**, *Ottawa, ON*.

Invited seminars

Direct(ional) Detection of Dark Matter at the High Mass Frontier

2025/08 **IISc, Bengaluru**, *recycled talk at seminar course for grad students in Physics, IISc*.

The Neutrino Roof

2024/09 **JUSL Collaboration Meeting**, *Saha Institute of Nuclear Physics, Kolkata*, virtual.

Dark Matter Through a New (Micro)lens

2024/09 **International Centre for Theoretical Sciences**, *Bengaluru*.

Compact Stars as Calorimeters of Dark Matter

2023/10 **Indian Institute of Science Education and Research**, *Pune*.

2023/06 **Majorana-Raychaudhuri Seminar**, *University of Salerno, Italy & Indian Statistical Institute*, virtual.

Dark Neutrons: Cosmology, Astrophysics, and Laboratory

2023/02 **SNOLAB**, *Sudbury, ON*, virtual.

2023/02 **Tata Institute of Fundamental Research**, *Mumbai*.

2023/01 **Indian Institute of Technology Bombay**, *Mumbai*, virtual.

2022/12 **Institute of Mathematical Sciences**, *Chennai*.

2021/09 **Indian Institute of Science**, *Bengaluru*, virtual.

2021/09 **Oklahoma State University**, *Stillwater*, virtual.

2021/07 **Network in Neutrinos, Nuclear Astrophysics and Symmetries**, *University of California Berkeley*, virtual.

Overview of Dark Matter

2022/12 **Chennai Mathematical Institute**, blackboard talk.

Dark Matter Direct Detection in an Inter-Clump Void

2021/09 **Ohio State University**, *Columbus*, virtual CCAPP AstroParticle Lunch.

Direct(ional) Detection of Dark Matter at the High Mass Frontier

2021/03 **Newton 1665**, *Zoom*.

2020/07 **BSM PANDEMIC**, *Zoom*.

2019/10 **University of Utah**, *Salt Lake City*.

/09 **Brookhaven National Laboratory**, *Upton, NY*.

Neutrons, Electrons, and Pasta: Reheating the Neutron Star Soup with Dark Matter

2020/06 **Kavli Institute for the Physics and Mathematics of the Universe**, *Tokyo, Japan*, virtual.

/06 **Kavli Institute for Cosmological Physics, U Chicago**, *IL*, virtual.

/01 **University of Toronto**, *ON*.

/01 **York University**, *Toronto, ON*.

(Pre-)Supernova Neutrinos in Dark Matter Detectors

2020/05 **SuperNova Early Warning System Collaboration Meeting**, virtual.

Discovering Dark Matter by Reheating Pasta

2020/05 **TRIUMF Physical Sciences Division**, *Vancouver, BC*, virtual mixer.

Gravitational Microlensing by Dark Matter in Extended Structures

2020/01 **Queen's University**, *Kingston, ON*.

Multiscatter Footprints of Dark Matter

2019/03 **SNO+ Collaboration Meeting**, *SNOLAB, Sudbury, ON*.

/03 **DEAP-3600 Analysis Meeting**, virtual.

/02 **University of Oregon**, *Eugene*.

2018/06 **Indian Institute of Technology Madras**, *Chennai*.

/03 **Dartmouth College**, *Hanover, NH*, virtual.

Dark Fires in the Sky: Model-Independent Dark Matter Detection with Neutron Stars

2018/10 **TRIUMF**, *Vancouver, BC* .

/01 **Washington University**, *St Louis, MO*.

2017/11 **University of Michigan**, *Ann Abor, MI*.

/11 **Purdue University**, *West Lafayette, IN*.

/10 **Harvard University**, *Cambridge, MA*.

/10 **Massachusetts Institute of Technology**, *Cambridge, MA*.

/10 **SLAC National Laboratory**, *Menlo Park, CA*.

/10 **University of California Berkeley**.

/10 **California Institute of Technology**, *Pasadena*.

/10 **University of California Los Angeles**.

/10 **University of Washington**, *Seattle*.

/04 **University of California Riverside**, blackboard talk.

Drell-Yan Beyond Breit-Wigner

2018/09 **ATLAS Dilepton Group Meeting**, *CERN*, virtual.

2017/12 **University of Victoria**, *BC*.

/12 **TRIUMF**, *Vancouver, BC*, postdoc interview.

/09 **University of California Irvine**.

New Physics in Dilepton Scattering Angles

2017/04 **Perimeter Institute for Theoretical Physics**, *Waterloo, ON* .

/04 **University of California Santa Cruz**.

/02 **University of Cincinnati**, *OH*.

2016/11 **University of California Davis**.

/09 **University of Illinois at Chicago**.

Compressed Gluinos at the LHC

2016/04 **Fermi National Laboratory**, *Batavia, IL* .

/04 **Argonne National Laboratory**, *Lemont, IL* .

A 125 GeV Higgs from Higgs Loops

2015/11 **University of Notre Dame**, *IN*.

Dark Matter in Dileptons

2015/07 **Institute of Mathematical Sciences**, *Chennai, India*.

/03 **University of Washington**, *Seattle*.

/02 **University of Oregon**, *Eugene*.

2014/12 **University of Wisconsin**, *Madison*.

/12 **University of Notre Dame**, *IN*.

/12 **Michigan State University**, *East Lansing*.

/12 **University of Maryland**, *College Park*.

/12 **Argonne National Laboratory**, *Lemont, IL* .

The 'Tang'ible Enigma of Flavor

2015/05 **University of Oregon**, *Eugene*, for non-specialist grad students.

Supersymmetry and Dark Matter at the LHC

2013/12 **Indian Institute of Technology Madras**, *Chennai*.

Conferences & workshops

Dark, Deep, Deconfining: Neutron Star Phase Transitions Probing Hidden Sectors

2025/12 **Neighbourhood Cosmology Meeting**, *Indian Institute of Astrophysics, Bengaluru*.

2025/08 **Brainstorming on Neutron Stars**, *Institute of Mathematical Sciences, Chennai, India*.

Compact Stars as Laboratories of Dark Matter

2025/05 **European Consortium for Astroparticle Theory**, *CERN, Geneva*, virtual conference.

Direct Searches of Dark Matter Around the Planck Mass

2025/01 **From Big Bang to Now: A Theory-Experiment Dialogue**, *SRM University AP*, Amaravati.

The Primordial Black Hole Dark Matter Mass Window

2024/12 **Bangalore Cosmology Meeting**, *Raman Research Institute*, panel discussion alongside Ranjan Laha.

The Neutrino Roof of Dark Matter Direct Detection

2024/10 **17th International Conference on Interconnections between Particle Physics and Cosmology**, *Indian Institute of Technology Hyderabad*.

2024/08 **Workshop on Dark Matter and Astroparticle Physics**, *Institute of Physics*, Bhubaneshwar, India.

Repurposing Neutrino Detectors to Hunt Dark Matter

2024/04 **Understanding the Universe Through Neutrinos [summer school]**, *International Centre for Theoretical Sciences*, Bengaluru, India.

Dark Sectors Overheating Neutron Stars

2024/01 **Workshop in High Energy Physics Phenomenology**, *Indian Institute of Technology Gandhinagar*, blackboard talk.

Dark Matter in Compact Stars: an Overview

2023/12 **International Conference on High Energy Particle & Astroparticle Physics 2023**, *Saha Institute of Nuclear Physics*, Kolkata.

2023/11 **YOUNGST@RS - Interacting Dark Sectors in Astrophysics, Cosmology, and the Lab**, *Mainz Institute for Theoretical Physics, Johannes Gutenberg University, Germany*, virtual.

Hunting Dark Matter: an Overview

2023/11 **CHEP In-House Symposium**, *Indian Institute of Science*.

Dark Baryons in Cosmology

2023/11 **Bangalore Cosmology Meeting**, *Raman Research Institute*.

Direct(ional) Detection of Dark Matter at the Planck Mass and Beyond

2023/03 **Less Travelled Path to the Dark Universe**, *International Centre for Theoretical Sciences*, Bengaluru, India.

Discovering Dark Matter with Neutron Stars – and Vice Versa

2023/02 **Neutron Stars: The Celestial Clocks that Probe Extreme Physics**, *Institute of Mathematical Sciences, Chennai, India*, plenary talk.

Ultraheavy Dark Matter

2022/11 **Dark Interactions: New Perspectives from Theory and Experiment**, *Brookhaven National Lab, Upton, NY*, plenary talk, virtual.

2022/09 **Neutrino Theory Mini-Workshop**, *Snowmass 2021*.

/08 **McDonald Institute National Meeting**, *VirBELA*.

Dark sectors in neutrons-shining-through-a-wall and nuclear absorption in neutrino facilities

2022/05 **Neutrino 2022**, *Institute of Basic Science, Seoul, Korea*, virtual poster.

Detecting Dark Matter Subhalos in Neutron Star Heating

2021/11 **Vancouver Cosmology Meeting**, *SFU Harbour Centre, Vancouver, BC*.

The History and Fate of Dark Neutrons

2021/11 **Brookhaven Forum 2021: Opening New Windows to the Universe**, *Brookhaven National Lab, Upton, NY*, virtual.

2021/09 **Dark Matter 2021**, *Instituto de Física de Cantabria, Santander, Spain*, virtual.

2021/08 **TRIUMF Science Week 2021**, *Vancouver, BC*, virtual.

2021/05 **PPC 2021: International Conference on Interconnections between Particle Physics and Cosmology**, *University of Oklahoma, Norman, OK*, virtual.

2020/12 **Vancouver Cosmology Meeting**, *Vancouver, BC*, virtual.

Neutron stars as Pauli batteries: probing the neutron portal with internal heating of pulsars

2021/05 **PHENO 2021**, *Pittsburgh, PA*, virtual.

Breaking up the Proton with New Forces

2021/03 **A Rainbow of Dark Sectors**, *Aspen Center for Physics, CO*, virtual.

2020/11 **Advisory Committee on TRIUMF**, *Vancouver, BC*, Theory group review.

Neutrons, Electrons, and Pasta

2020/09 **Pacific Northwest Theory Workshop**, *University of Oregon*.

(Pre-)Supernova Neutrinos in Dark Matter Detectors

2019/06 **Progress after Impasse: New Frontiers in Dark Matter**, *Aspen Center for Physics, CO*.

/05 **Pacific Northwest Theory Workshop**, *University of Oregon*.

Discovering Dark Matter by Reheating Pasta

2020/03 **New Techniques for Dark Matter Discovery**, *TRIUMF, Vancouver, BC*.

2019/10 **Vancouver Cosmology Meeting**, *SFU Harbour Centre, Vancouver, BC*.

Gravitational Microlensing by Dark Matter in Extended Structures

2020/02 **Vancouver Cosmology Meeting**, *TRIUMF, Vancouver, BC*.

Multiscatter Footprints of Dark Matter

2019/02 **Dark Matter in its Natural Habitat**, *TRIUMF, Vancouver, BC*.

2018/11 **Advisory Committee on TRIUMF**, *Vancouver, BC*, Theory group review.

/06 **Santa Fe Summer Workshop**, *NM*.

/05 **PHENO 2018**, *University of Pittsburgh, PA*, parallel talk.

/04 **Towards Dark Matter Discovery**, *University of Chicago, IL*, chalkboard talk.

/03 **Current Trends in Particle Theory 2018**, *University of Illinois at Chicago*.

Dark Fires in the Sky: Neutron Stars as Thermal Detectors of Dark Matter

2017/08 **TeV Particle Astrophysics (TeVPA) 2017**, *Ohio State University, Columbus*.

/07 **New Directions in Dark Matter and Neutrino Physics**, *Perimeter Institute, Waterloo, ON*.

/05 **PHENO 2017**, *University of Pittsburgh, PA*, parallel talk.

Forbidden WIMPs – Aren't

2016/05 **PHENO 2016**, *University of Pittsburgh, PA*, parallel talk.

Compressed Gluinos at the LHC

2016/07 **Santa Fe Summer Workshop**, *NM*.

Dark Matter in Dileptons

2017/04 **DM@LHC**, *University of California Irvine*.

2014/08 **SLAC Summer Institute 2014**, *Menlo Park, CA*, 'Shining Light on Dark Matter'.

/05 **PHENO 2014**, *University of Pittsburgh, PA*, parallel talk.

How Do You Measure the Invisible Decay Width of the Higgs?

2014/08 **SLAC Summer Institute 2014**, *Menlo Park, CA*, 'Shining Light on Dark Matter'.

Mixed Gauginos

2013/06 **Theoretical Advanced Study Institute (TASI) 2013**, *University of Colorado, Boulder*.

Other conferences attended

2025/11 **TeV Particle Astrophysics (TeVPA) 2025**, *University of Valencia, Spain*, convenor for Dark Matter Indirect Detection track.

2024/08 **Frontiers in Particle Physics**, *CHEP, IISc, Bengaluru*.

2022/09 **GUINEAPIG Workshop on Light Dark Matter**, *TRIUMF, Vancouver, BC*.

2022/08 **Quantum Gravity Conference**, *Vancouver, BC*.

2022/05 **European Consortium for Astroparticle Theory**, *virtual conference*.

2022/04 **Pacific Northwest Particle Theory Meeting**, *University of British Columbia, Vancouver*.

2022/04 **Vancouver Cosmology Meeting**, *SFU Harbour Centre, Vancouver, BC*.

2022/02 **Neutrinos as a Portal to New Physics and Astrophysics**, *Kavli Institute for Theoretical Physics, University of California Santa Barbara*, virtual.

2021/12 **Light Dark World**, *University of Pittsburgh, PA*, virtual.

2021/08 **Topics in Astroparticle & Underground Physics (TAUP) 2021**, *IFIC, Valencia*, virtual.

2021/05 **SNEWS Collaboration Meeting 2021**, virtual.

2021/02 **Winter Nuclear and Particle Physics Conference 2021**, *McGill University*, virtual.

2020/11 **Developing New Directions in Fundamental Physics (DND)**, *Pacific Northwest groups*, virtual.

/07 **Baryon Lepton Violation 2020**, *Case Western University, OH*, virtual.

2019/08 **Dark Matter at LHC**, *University of Washington, Seattle*.

2017/03 **Current Trends in Particle Theory 2017**, *University of Illinois at Chicago*.

2016/11 **Higgs Couplings 2016**, *SLAC National Laboratory, Menlo Park, CA*.

/11 **Exotic Higgs Decays Meeting**, *SLAC National Laboratory, Menlo Park, CA*.

2015/12 **Dark Matter at a Future Hadron Collider**, *Fermi National Laboratory, Batavia, IL*.

2014/08 **Physics at a 100 TeV Collider**, *SLAC National Laboratory, Menlo Park, CA*.

2015/05 **PHENO 2015**, *University of Pittsburgh, PA*.

Publications

White papers

co-ordinator
arXiv:2203.06508 [hep-ph]
Ultraheavy particle dark matter
Snowmass 2021 Cosmic Frontier white paper
SciPost Physics Core 6, 075 (2023)

contributor
arXiv:2203.07984 [hep-ph]
Dark Matter in Extreme Astrophysical Environments
Snowmass 2021 Cosmic Frontier white paper

contributor
arXiv:2203.02309 [physics.ins-det]
A Next-Generation Liquid Xenon Observatory for Dark Matter and Neutrino Physics
Journal of Physics G: Nucl. Part. Phys. 50 (2023) 013001

contributor
arXiv:2011.00035 [astro-ph.HE]
SNEWS 2.0: A Next-Generation SuperNova Early Warning System for Multi-messenger Astronomy
New Journal of Physics 23, 031201 (2021)

PopSci

arXiv:2210.10623 [physics.pop-ph]
Names from Greek myth in fundamental physics
N. Raj

Selected publications

* featured as Editors' Suggestion

47.
arXiv:2403.07496 [astro-ph.HE]
Reheated Sub-40000 Kelvin neutron stars at the JWST, ELT, and TMT
N. Raj, P. Shivanna, G. N. Rachh
Phys. Rev. D 109, 123040 (2024)*
also featured on IISc and PRD homepages

46.
arXiv:2109.04582 [hep-ph]
Scattering searches for dark matter in subhalos: neutron stars, cosmic rays, old rocks
J. Bramante, B. Kavanagh, N. Raj
Phys. Rev. Lett. 128, 231801 (2022)

45.
arXiv:2108.09405 [astro-ph.CO]
First direct detection constraints on Planck mass dark matter using DEAP-3600
DEAP collaboration & N. Raj
Phys. Rev. Lett. 128, 011801 (2022)

44.
arXiv:2105.09951 [hep-ph]
Smoke and mirrors: Neutron star internal heating constraints on mirror matter
D. McKeen, M. Pospelov, N. Raj
Phys. Rev. Lett. 127, 061805 (2021)

43.
arXiv:2007.15655 [hep-ph]
Breaking up the proton: An affair with dark forces
G. Kribs, D. McKeen, N. Raj
Phys. Rev. Lett. 126, 011801 (2021)

42.
arXiv:2006.15140 [hep-ph]
Hydrogen portal to exotic radioactivity
D. McKeen, M. Pospelov, N. Raj
Phys. Rev. Lett. 125, 231803 (2020)*

41.
arXiv:1907.05331 [hep-ph]
Neutrinos from Type Ia and failed core-collapse supernovae at dark matter detectors
N. Raj
Phys. Rev. Lett. 124, 141802 (2020)

40. An infrared window on dark kinetic heating of neutron stars
arXiv:1704.01577 [hep-ph]
M. Baryakhtar, J. Bramante, S. W. Li, T. Linden, N. Raj
Phys. Rev. Lett. 119, 131801 (2017)

39. Anticipating non-resonant new physics in LHC dilepton angular spectra
arXiv:1610.03795 [hep-ph]
N. Raj
Phys. Rev. D 95, 015011 (2017)
2025 paper on experimental search results, directly based on this publication, conducted by the Compact Muon Solenoid collaboration at the Large Hadron Collider.

Further publications

38. Hawking heating of neutron stars by dark matter
arXiv:2511.19599 [hep-ph]
A. K. Saha, A. Dubey, N. Raj
submitted to **Physical Review Letters**

37. Direct detection of electromagnetically interacting ultraheavy dark matter
arXiv:2509.24938 [hep-ph]
J. Kumar, B. Mondal, G. Muralidhara, N. Raj
submitted to **PRD Letters**

36. Dark, deep, deconfining: Phase transitions in neutron stars as powerful probes of hidden sectors
arXiv:2507.08076 [hep-ph]
A. Bhutani, N. Raj, Z. Zuraiq
submitted to **PRD Letters**

35. ν limits from Super-Kamiokande on dark matter-electron scattering in the Sun
arXiv:2503.07713 [hep-ph]
D. Krishna, R. Sherpa, A. K. Saha, T. N. Maity, R. Laha, N. Raj
submitted to **PRD**

34. Seeking the nearest neutron stars using a new local electron density map
arXiv:2411.18647 [hep-ph]
J. Bramante, K. Mack, N. Raj, L. Shao, N. Tyagi
accepted at **JCAP**

33. Beyond Hawking evaporation of black holes formed by dark matter in compact stars
arXiv: 2410.22702 [hep-ph]
U. Basumatary, N. Raj, A. Ray
Phys. Rev. D Letters 111, L041306 (2025)

32. Ultraheavy multiscattering dark matter: DUNE, CYGNUS, kilotonne detectors, and tidal streams
arXiv:2410.22168 [hep-ph]
H. Aggarwal, N. Raj
Phys. Rev. D 111, 043010 (2025)

31. Neutrino roof: Single-scatter ceilings in dark matter direct detection
arXiv:2406.17015 [hep-ph]
N. Raj, B. Mondal
Phys. Rev. D 110, 095023 (2024)

30. Breaking into the window of primordial black hole dark matter with x-ray microlensing
arXiv:2405.20365 [astro-ph.HE]
M. Tamta, N. Raj, P. Sharma
Phys. Rev. D. 111, 043043 (2025)

29. Cosmology of self-replicating universes in black holes formed by dark matter-seeded stellar collapse
arXiv:2405.12277 [hep-ph]
J. Bramante, N. Raj
Phys. Rev. D 110, 043537 (2024)

28. Dark matter in compact stars
arXiv:2307.14435 [hep-ph]
J. Bramante, N. Raj
Physics Reports 1052 (2024)

27. Supernovae and superbursts by dark matter clumps
arXiv:2306.14981 [hep-ph]
N. Raj
Phys. Rev. D 109, 123020 (2024)

26. Could compact stars in globular clusters constrain dark matter?
arXiv:2303.18009 [astro-ph.HE]
R. Garani, N. Raj, J. Reynoso-Cordova
Journal of Cosmology and Astroparticle Physics 07, 038 (2023)

25. Light dark matter accumulating in terrestrial planets: nuclear scattering
arXiv:2210.01812 [hep-ph]
J. Bramante, J. Kumar, G. Mohlabeng, N. Raj, N. Song
Phys. Rev. D 108, 063022 (2023)

24. Neutron star observations of pseudoscalar-mediated dark matter
arXiv:2207.02221 [hep-ph]
J. Coffey, D. McKeen, D. Morrisey, N. Raj
Phys. Rev. D 106, 115019 (2022)

23. Dark sectors in neutron-shining-through-a-wall and nuclear absorption signals
arXiv:2201.02603 [hep-ph]
M. Hostert, D. McKeen, M. Pospelov, N. Raj
Phys. Rev. D 107, 075034 (2023)

22. Cosmological and astrophysical probes of dark baryons
arXiv:2012.09865 [hep-ph]
D. McKeen, M. Pospelov, N. Raj
Phys. Rev. D 103, 115002 (2021)

21. Observing the thermalization of dark matter in neutron stars
arXiv:2009.10728 [hep-ph]
R. Garani, A. Gupta, N. Raj
Phys. Rev. D 103, 043019 (2021)

20. Subaru-HSC through a different lens: microlensing by extended dark matter structures
arXiv:2007.12697 [astro-ph.CO]
D. Croon, D. McKeen, N. Raj, Z. Wang
Phys. Rev. D 102, 083021 (2020)

19. Dark kinetic heating of neutron stars from contact interactions with relativistic targets
arXiv:2004.09539 [hep-ph]
A. Joglekar, N. Raj, P. Tanedo, H-B. Yu
Phys. Rev. D 102, 123002 (2020)

18. Gravitational microlensing by dark matter in extended structures
arXiv:2002.08962 [astro-ph.CO]
D. Croon, D. McKeen, N. Raj
Phys. Rev. D 101, 083013 (2020)

17. Relativistic capture of dark matter by electrons in neutron stars
arXiv:1911.13293 [hep-ph]
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