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Current Research Interest

The dynamic evolution of large-scale magnetic structure in interplanetary space, their interactions, the energy exchange processes involved therein, their geo-effectiveness and their effect on cosmic ray modulation.

keywords: Coronal mass ejections (CMEs), Co-rotating interacting regions (CIRs), solar wind, magnetic clouds, shock-sheath regions, geomagnetic storms, cosmic ray modulation, Forbush Decrease, ground level enhancement (GLE), magnetic reconnection, magneto-hydrodynamic waves etc.

PUBLICATIONS

PEER REVIEWED PAPERS

- 2017 Forbush decrease: A new perspective with classification, Anil Raghav***, Zubair Shaikh, Ankush Bhaskar, Gauri Datar, Geeta Vichare, Solar Physics 292, no. 8 (2017): 99., DOI:10.1007/s11207-017-1121-4, arXiv preprint arXiv:1608.03772, **impact factor-2.682**
- 2017 Presence of Turbulent and Ordered Local Structure within ICME Shock-sheath and Its Contribution to Forbush Decrease** Zubair Shaikh, **Anil Raghav***, and Ankush Bhaskar, The Astrophysical Journal, Volume 844, Number 2 , 2017 July 28, arXiv preprint arXiv:1612.07895, **impact factor-5.533**
- 2017 High-spin states in Cs 133 and the shell model description.** Biswas S, Palit R, Sethi J, Saha S, **Raghav A**, Garg U, Laskar MS, Babra FS, Naik Z, Sharma S, Deo AY. Physical Review C. 2017 Jun 22;95(6):064320. **impact factor-3.82**

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- 2016** The role of solar wind speed and interplanetary magnetic field in Forbush decreases, Ankush Bhaskar, Geeta Vichare, K.P. Arunbabu and [Anil Raghav](#), *Astrophysics and Space Science* **361**, 7, 1-132 (2016) **impact factor-1.622**
- 2014** Quantitative understanding of Forbush decrease drivers based on shock-only and CME-only models using global signature of February 14, 1978 event, [Anil Raghav*](#), Ankush Bhaskar, Ajay Lotekar, Geeta Vichare and Virendra Yadav, *Journal of Cosmology and Astroparticle Physics (JCAP)* 10 (2014) 074 doi:10.1088/1475-7516/2014/10/074 (arXiv:1406.4608) **impact factor-5.877**
- 2014** Low energy secondary cosmic ray flux (gamma rays) monitoring and its constraints, [Anil Raghav](#), Ankush Bhaskar, Virendra Yadav and Nitinkumar Bijewar, *Astrophys Space Sci* (2014) 355:2172, DOI: 10.1007/s10509-014-2172-8 arXiv:1408.1761.
- 2013** Confirmation of secondary cosmic ray flux enhancement during the total lunar eclipse of 10 December 2011, [A. Raghav et al.](#), *Journal of Geophysical Research: space physics* vol. 118, doi:10.1002/2013JA019007, arXiv:1212.4240v1 **impact factor-3.44**
- 2012** Small quadrupole deformation for the dipole bands in ^{112}In , [A. Raghav](#) in T. Trivedi et al. *Phys. Rev. C* 85, 014327 **impact factor-3.341**
- 2011** Structural change of the unique-parity $\pi h_{11/2} \otimes \nu h_{11/2}$ configuration in ^{134}Cs , [A. Raghav](#) in H. Pai et al., *Phys. Rev. (Rapid Comm.) C* 84, 041301 **impact factor-3.341**
- 2011** Complete and incomplete fusion in $^9\text{Be} + ^{124}\text{Sn}$ system, [A. Raghav](#) in V. V. Parkar et al., *Proc. Radiochim. Acta* 1, 131-134
- 2011** A study of secondary cosmic ray flux variation during the annular eclipse of 15 January 2010 at Rameswaram, India, [A. Raghav](#) in Ankush Bhaskar et al., *Astroparticle Physics* 35, 223-229 **impact factor-4.023**.
- 2010** Fusion cross sections for the $^9\text{Be} + ^{124}\text{Sn}$ reaction at energies near the Coulomb barrier, [A. Raghav](#) in V. Parkar et al., *Phys. Rev. C* 82, 054601. **impact factor-3.341**

PAPERS UNDER-REVIEW PROCESS OR ARXIV

- 2017** *In situ* observation of less twisted flux rope embedded within the highly twisted flux rope envelope, [Anil Raghav*](#) W. Mishra, Y. Wang, A. Bhaskar, Z. Shaikh. under preparation

- 2017** The First *insitu* observation of torsional Alfvén waves during the interaction of large-scale magnetic clouds, Anil Raghav* Ankita Kule, submitted to mnras letter.
- 2017** Equatorial Secondary Cosmic Ray Observatory to study space weather and terrestrial events, Geeta Vichare, Ankush Bhaskar, Gauri Datar, Anil Raghav, K.U. Nair, Selvaraj, Ananthi, A.K. Sinha, M. Paranjape, T. Gawade, C.P. Anil, Pannerselvam, Sathishkumar, K. Jeeva, S. Gurubaran, submitted to Advances in Space Research journal
- 2016** Cosmic ray acceleration via magnetic reconnection of magnetic islands/flux-ropes, Anil Raghav, Zubair Shaikh, arXiv:1610.09628.
- 2014** Lunar eclipse induces disturbance in the lunar exosphere, A. Raghav et al., arXiv:1401.6559.

CONFERENCE PRESENTATIONS

- 2010** Structure of Dipole Bands in ^{112}In : Through Lifetime Measurement, A. Raghav in T. Trivedi et al., *Journal of Physics: Conference Series*, presented in Rutherford Centennial Conference.
- 2009** High spin structure of ^{133}Cs , A. Raghav et al., poster presentation in *International DAE Nuclear Physics symposium held at Bhabha Atomic Research Centre, Mumbai* during 08-12 December, 2009
- 2009** High spin spectroscopy of ^{134}Cs , A. Raghav in H. Rai et al., poster presentation in *International DAE Nuclear Physics symposium held at Bhabha Atomic Research Centre, Mumbai* during 08-12 December, 2009.
- 2009** Complete and incomplete fusion cross-sections in $^9\text{Be} + ^{124}\text{Sn}$ system and its implications in horizontal spectroscopy A. Raghav in V. V. Parkar et al., poster presentation in *International DAE Nuclear Physics symposium held at Bhabha Atomic Research Centre, Mumbai* during 08-12 December, 2009.
- 2008** Particle Identification in CsI(Tl) detectors A. Raghav in R. Palit et al., Poster Presentation in *DAE-BRNS Symposium on Nuclear Physics*, Indian Institute of Technology Roorkee, Roorkee -247667, December 22-26, INDIA-2008.
- 2006** Hybrid detector telescope for fission fragment and heavy ions, A. Raghav in D. C. Biswas et al., presentation in *DAE-BRNS symposium on Nuclear Physics* held at The Maharaja Sayajirao University of Baroda, Vadodara during 11-15 December, 2006.

TRAINING PROGRAM/ WORKSHOP /SCHOOL ATTENDED

- 2017 2 month training under the SCOSTEP Visiting Scholar (SVS) program, at CAS Key Laboratory of Geospace Environment, University of Science and Technology of China (USTC).** In this program, I have studied velocity modified cylindrical force free flux rope model based on Lundquist solution and velocity modified non-linear (uniform twist) force free flux model with Gold and Hoyle (GH) solution under the supervision of Prof. Yuming Wang.
- 2015 Ninth Heliophysics Summer School 2015,** conducted by *the University Corporation for Atmospheric Research (UCAR)*, held in Boulder, Colorado, July 28 - August 4, 2015 under NASA 'living with star' funds.
- 2015 Refresher Course in Astronomy and Astrophysics** conducted by *The Inter-University Centre for Astronomy and Astrophysics (IUCAA)* , Pune from May 05, 2015 to June 05, 2015.
- 2014 28 days Orientation Course** conducted by *UGC Academic Staff College, University of Mumbai*, Mumbai from September 03, 2014 to October 01, 2014.
- 2013 Six days training program on Computer Interfaced Science Experiments** conducted by *Inter University Accelerator Centre*, New Delhi from October 14, 2013 to October 19, 2013.
- 2013 Two days National workshop on Python in Science and Education** jointly organized by *Department of Physics, University of Mumbai and Inter University Accelerator Centre*, New Delhi on 19-20 September 2013
- 2013 One day workshop on Effective implementation of credit based system for M. Sc.-II course including elective E-I and E-II** organized by *Department of Physics, K. J. Somaiya College of Science and Commerce*, Mumbai on July 10, 2013.
- 2012 7th Winter School on Astro-Particle Physics** held at *Cosmic ray laboratory, TIFR*, Ooty, during the period from December 20, 2012 to December 28, 2012.
- 2012 7th workshop on Astro-Particle Physics** held at *Cosmic ray laboratory, TIFR*, Ooty, during the period from December 16, 2012 to December 19, 2012.
- 2012 Science Academies Refresher Course in Theoretical Physics** at *Department of Physics, University of Mumbai* from July 16, 2012 to July 28, 2012.
- 2009 UGC sponsored Refresher Course in Physics** at *Department of Physics, University of Mumbai* from September 23, 2009 to October 12, 2009.

2009 School cum workshop on Nuclear Yrast and Near Yrast States held at Department of Physics, *Indian institute of Technology, Roorkee*, during the period of October 26-30, 2009.

ACHIEVEMENTS

Detail of Prizes/Awards/scholarships achievements:

2017 SCOSTEP Visiting Scholarship 2017 .

2015 Selected for NASA "Living with star" project funds, to attend *Heliophysics Summer school 2015*.

2007 SET Exam Feb2007, *Common Entrance Test for lecturer-ship at state level*.

2007 JEST Exam 2007, *National level Ph.D. entrance test with 94.88 percentile..*

2005 Meritorious Student, in T. Y. B.Sc.,.

I have achieved 2nd rank from Mumbai University in the subject of Physics.

2005 Awarded by six prizes, by PATKAR- VARDE COLLEGE, MUMBAI.

as I have secured 1st rank (highest Marks) at all faculty level of college.

EDUCATION

Qualification Ph.D. in Science (Physics)

August 2009- May 2015

Institute University Department of Physics, Mumbai, India

University University of Mumbai, Mumbai, India

Subject Space Physics

Title Study of Secondary Cosmic Ray Flux Variation During Certain Natural Events

Summary We have developed a secondary cosmic ray (SCR), mainly gamma ray, flux monitoring setup (energy range of 0.2-4 MeV) using 3 inch X 3 inch NaI(Tl) scintillation detector. Using this setup, we have studied temporal variation of SCR flux during eclipses (Annular solar eclipse and total lunar eclipse). The experimental results confirmed previous observations and advance our understanding of the various possible physical mechanisms behind this SCR variations during eclipses. We have performed similar type of experiments during full-moon day, new-moon day and days close to them. During these experiments, we have observed couple of abnormal events which show presence of atmospheric radioactivity (radioactive Ar^{41}). This is the first successful foray in the field of experimental Space Physics research by the Mumbai University, Department of Physics with in-house instrumentation and data acquisition system.

We have also carried out the quantitative understanding of Forbush decrease (FD) phenomena. To the best of our knowledge, this is the first time FD shock amplitude component has been separated from total FD amplitude, and FD shock and MC component investigated independently using CME-only and shock-only model. This work confirms present accepted the physical scenario that the first step of FD is due to propagating shock barrier and the second step is due to flux rope of CME/magnetic cloud.

Contribution In this work, I have contributed to: (1) development, testing and characterization of the SCR flux monitoring setup (2) Developing formalism for data processes and analysis (3) actual data analysis and (4) finally, writing manuscript for papers. The numerical calculations involved in study, which were performed using code in Scilab and Matlab software.

Qualification **Master of Science (M.Sc.) in Physics**

2005-2007

Institute **University Department of Physics, Mumbai, India**

University **University of Mumbai, Mumbai, India**

Subject

M.Sc. Part I

Mathematical Physics
Classical Mechanics
Quantum Mechanics-I
Nuclear Physics
Quantum Mechanics-II
Solid State Physics
Electronics
Solid State Devices
percentage 71.0 %

M.Sc. Part II

Statistical Physics
Electrodynamics
Atomic and Molecular Physics
Laser and Plasma Physics
Advanced Nuclear Physics
Nuclear Reaction, Nuclear Structure
Particle Physics
Exp. Techniques In Nuclear Physics
Percentage 65.6 %

Overall Percentage in M.Sc. Course – 68.3 %

- ** Project Fellow** at Tata Institute of Fundamental Research (TIFR), Mumbai from October 30, 2007 to 30 April 2008.

During this work, I have Participated in testing of HPGe clover Detector, Cs-I charge particle detector and its respective signal processing instrumentation. I have also participated in heavy ion-beam experiments using pelletron facility at intermediate beam energy range available at (TIFR) and Inter University accelerator centre (IUAC). We have used Gamma Detector Array (GDA) facility at TIFR, and Indian National Gamma Array (INGA) facility at IUAC. These experiments lead us to investigate high spin nuclear structure properties for intermediate mass region $A \sim 110$ and $A \sim 130$ nuclei. In this work, I have learned nuclear radiation detection techniques and instrumentation, data acquisition and analysis of the data generated using these experiments. During this data processing and analysis I have worked with different sophisticated softwares (PACE, CASCADE, RADWARE, LAMPS, CANDLER, DAMM and xmgrace) based on LINUX operating system.

Note Participation in Nuclear structure group start from June 2008 and even after ending the project fellowship, I have participated in group till 2010.

Project

1. **Project trainee** at Nuclear Physics Division, Bhabha Atomic Research Centre (BARC), Mumbai from May 1, 2006 to July 15, 2006.

During this work ,I have participated in the development of a hybrid telescope for the detection of heavy ions and fission fragments produced in heavy ions reaction.

2. I have done project titled '[Design and working of multi-wire proportional chamber \(MWPC\)](#)' in the detector laboratory at Inter University Accelerator Center (IUAC), Delhi under the guidance of Mr. Akhil Jhingan.
3. I have done a project on '[Compton Scattering Effect](#)' at University Department of Physics, University of Mumbai, Mumbai in year of 2006-2007.
4. I have done project titled '[Mean Lifetime Measurement of Muon](#)' at Indian Institute of Technology (IIT), Mumbai in year of 2005-2006.

Qualification [B. Sc. \(Bachelor of Science\) in Physics](#) 2002-2005

Institute **Patkar–Varde College**, Goregoan-west, Mumbai, India

University **University of Mumbai**, Mumbai, India

Subject Third Year B. Sc.

Major Subject

Solid State Physics and Electronics	Classical and Statistical Mechanics
Atomic and Nuclear Physics	Electrodynamics and Relativity

Minor Subject

Electronic Instrumentation-I	Electronic Instrumentation-II
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Percentage 85.75 %

Qualification [H.S.C.\(Higher Secondary Certificate \)](#) 2000-2002

Institute **Vartak Junior College** Vasai road, Thane, India

Board **Mumbai Divisional Board**, Mumbai, India

Percentage 71.00 %

Qualification [S.S.C.\(Secondary School Certificate\)](#) 2000

Institute **Abhinav Vidya Mandir**, Bhayander, Thane, India

Board **Mumbai Divisional Board**, Mumbai, India

Percentage 75.76 %

COMPUTER SKILLS

[OPERATING SYSTEM](#)

Linux (Ubuntu and Fedora) and Windows (user)

[SOFTWARES](#)

Microsoft Office (Word, Excel, Powerpoint), Matlab, Scilab, Origin, Latex, Programming Languages known (c, Fortran, Python), xmgrace

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PERSONAL DATA

Date of Birth January 06, 1984

Gender Male

Nationality Indian

Marital Status Married

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e-mail raghavanil1984@gmail.com and anil.raghav@physics.mu.ac.in

Current Position **Assistant Professor**, University Department of Physics (UDP), University of Mumbai, From December 17, 2008 to till date.

Teaching Experience **Total 9.5 years**, i.e. 9 in Postgraduate teaching at Department of Physics, University of Mumbai and 6 months in undergraduate teaching at K.C. College, Churchgate, Mumbai from 23 June 2008 to 16 December 2008.

Language known

Advanced English *fluent*

Mothertongue Marathi

Advanced Hindi *fluent*

Contributions in Physics Department, University of Mumbai

Teaching Laboratory Courses

In-charge of **Nuclear Physics** laboratory for 8 years from 2009 to April 2017.

In-charge of **Astronomy and Space physics** laboratory for 3 years from 2014.

I have worked in **General Physics** laboratory of M.Sc. semester I for **4 years** (year 2009- 10, 2010-11 and year 2014-15 to till date).

Teaching Theory Courses

Electrodynamics (core course) for **2 years** (2015-16, 2016-17)

Experimental Techniques in Nuclear Physics (Elective course/ specialization) for **8 years** (2009-10, 2010-11, 2011-12, 2012-13, 2013-14, 2014-15, 2015-16, 2017-18.)

Nuclear Physics (core course) for **4 years** (2011-12, 2012-13, 2013-14, 2014-15.)

Nuclear Physics (Structure and Reaction) (Elective course/ specialization) for **2 years** (2009-10, 2010-11.)

visiting lecturer for M.Sc. Part I Physics course in Gogate Joglekar College of Arts, Commerce and Science, Ratnagiri, and S.H. Kelkar College of Arts, Commerce and Science, Devgad, Maharashtra.

Academic work Paper setter, examiner and moderator for University of Mumbai for **9 years**.

References

1. **Dr. M. R. Press,**

Ph.D. Guide, Associate Professor, Department of Physics (Autonomous), University of Mumbai, Santacruz (east), Mumbai, India- 400098

Email: mrpress@physics.mu.ac.in & mrpress01@gmail.com

2. **Dr. Anuradha Misra,**

Professor & Former Head, Department of Physics (Autonomous), University of Mumbai, Santacruz (east), Mumbai, India- 400098

Email: anuradha.misra@gmail.com

I hereby declare that the above mentioned information is correct up-to my knowledge and I bear the responsibility for correctness of the above mentioned particulars.

Place: **Mumbai**

(Anil Narayan Raghav)