Dr. Kuldeep Verma (Assistant Professor)

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Academic/Research Positions

12/07/2022 – present	Assistant Professor, Department of Physics, Indian Institute of Technology (BHU), Varanasi, India
01/11/2021 – 11/07/2022	Juan de la Cierva Fellow, Institute of Space Sciences (ICE-CSIC), Barcelona, Spain
01/05/2021 – 30/09/2022	Formal Long-term Affiliate, Stellar Astrophysics Centre (SAC), Department of Physics and Astronomy, Aarhus University (AU), Denmark
01/10/2016 – 30/04/2021	Postdoctoral Research Fellow, SAC, Department of Physics and Astronomy, AU, Denmark Supervisor: Dr. V. Aguirre Børsen-Koch, formerly Dr. V. Silva Aguirre

Academic degrees

27/07/2011 – 03/03/2017	PhD in Physics (Thesis submission: July 26, 2016; Thesis defence: October 14, 2016), Tata Institute of Fundamental Research (TIFR), Mumbai, India Supervisor: Prof. H. M. Antia
15/07/2009 – 25/07/2011	MSc in Physics (FGPA: 7.9/9.0, 1st class), Jawaharlal Nehru University, New Delhi, India
31/07/2006 – 08/06/2009	BSc in Physics/Mathematics/Chemistry(minor) (Marks: 74.2%, 1st class), University of Allahabad, Allahabad, India

Fellowships and Awards

2021	Received the Spanish Juan de la Cierva Incorporación Fellowship (93,000 Euro for 3 years)
2020	Invited for interview for the French CNES Postdoctoral Fellowship (had to withdraw the application at this stage because I already accepted the offer from University of New South Wales)
2020	Offered Research Associate position, University of New South Wales (UNSW), Sydney, Australia (accepted but could not travel to Australia because of the border restrictions due to COVID19)
2016	Offered Postdoctoral Fellowship, Instituto de Astrofisica e Ciências do Espaço, Universidade do Porto, Porto, Portugal
2014	Ratanbai Jerajani Award, for the best seminar in the area of Astronomy and Astrophysics, TIFR, Mumbai, India
2010	Junior Research Fellowship (JRF), in the subject of Physical Sciences under the Council of Scientific and Industrial Research (CSIR), India (All India Rank: 79)

Publications

As of August 2022, I am co-author of **34** publications indexed in the SAO/NASA Astrophysics Data System (H-index of **18** and a total of **1000+** citations). These include 25 articles in major astronomy journals (such as Nature Astronomy, The Astrophysical Journal Letter, The Astrophysical Journal, Astronomy & Astrophysics and Monthly Notices of the Royal Astronomical Society), 2 in conference proceedings (1 refereed and 1 non-refereed), 1 software, 5 online data catalogs and 1 erratum. Altogether, I am first author of 9 publications, while second author of 2.

Publications in peer-reviewed scientific journals

1. K. Verma, J. L. Rørsted, A. M. Serenelli, et al. 2022, "Advanced asteroseismic modelling: breaking the degeneracy between stellar mass and initial helium abundance", MNRAS, 515, 1492 (citations: 0)
2. E. Spitoni, V. Aguirre Børsen-Koch, K. Verma, et al. 2022, "Disc dichotomy signature in the vertical distribution of [Mg/Fe] and the delayed gas infall scenario", A&A, 663, A174 (citations: 0)
3. V. Aguirre Børsen-Koch, J. L. Rørsted, A. B. Justesen, …, K. Verma, et al. 2022, "The BAyesian STellar Algorithm (BASTA): a fitting tool for stellar studies, asteroseismology, exoplanets, and Galactic archaeology", MNRAS, 509, 4344 (citations: 8)
4. M. S. Cunha, I. W. Roxburgh, V. Aguirre Børsen-Koch, …, K. Verma, et al. 2021, "PLATO Hare-and-Hounds exercise: Asteroseismic model fitting of main-sequence solar-like pulsators", MNRAS, 508, 5864 (citations: 3)
5. K. Verma, R. J. J. Grand, V. Silva Aguirre, et al. 2021, "An observational testbed for cosmological zoom-in simulations: constraining stellar migration in the solar cylinder using asteroseismology", MNRAS, 506, 759 (citations: 5)
6. E. Spitoni, K. Verma, V. Silva Aguirre, et al. 2021, "APOGEE DR16: a multi-zone chemical evolution model for the Galactic disc based on MCMC methods", A&A, 647, A73 (citations: 26)
7. A. Pietrinferni, S. L. Hidalgo, S. Cassisi, …, K. Verma, et al. 2021, "The updated BaSTI stellar evolution models and isochrones: II. Alpha-enhanced calculations", ApJ, 908, 102 (citations: 22)
8. P. E. Nissen, J. Christensen-Dalsgaard, J. R. Mosumgaard, …, K. Verma, et al. 2020, "High-precision abundances of elements in solar-type stars: Evidence of two distinct sequences in abundance-age relations", A&A, 640, A81 (citations: 45)
9. E. Spitoni, K. Verma, V. Silva Aguirre, et al. 2020, "Galactic archaeology with asteroseismic ages part II: Confirmation of a delayed gas infall using Bayesian analysis based on MCMC methods", A&A, 635, A58 (citations: 29)
10. V. Silva Aguirre, D. Stello, A. Stokholm, …, K. Verma, et al. 2020, "Detection and characterisation of oscillating red giants: first results from the TESS satellite", ApJL, 889, L34 (citations: 26)
11. W. J. Chaplin, A. M. Serenelli, A. Miglio, …, K. Verma, et al. 2020, "Age dating of an early Milky Way merger via asteroseismology of the naked-eye star ν Indi", Nat Astron, 4, 382 **(**citations: 33**)**
12. K. Verma, V. Silva Aguirre, 2019, "Helium settling in F stars: constraining turbulent mixing using the observed helium glitch signature", MNRAS, 489, 1850 (citations: 16)
13. D. Huber, W. J. Chaplin, A. Chontos, …, K. Verma, et al. 2019, "A hot saturn orbiting an oscillating late subgiant discovered by *TESS*", AJ, 157, 245 (citations: 58)
14. K. Verma, K. Raodeo, S. Basu, et al. 2019, "Helium abundance in a sample of cool stars: measurements from asteroseismology", MNRAS, 483, 4678 (citations: 34)
15. B. Nsamba, T. L. Campante, M. J. P. F. G. Monteiro, …, K. Verma, et al. 2018, "Asteroseismic modelling of solar-type stars: internal systematics from input physics and surface correction methods", MNRAS, 477, 5052 (citations: 28)
16. S. L. Hidalgo, A. Pietrinferni, S. Cassisi, …, K. Verma, et al. 2018, "The updated *BaSTI* stellar evolution models and isochrones. I. solar-scaled calculations", ApJ, 856, 125 (citations: 129)
17. K. Verma, K. Raodeo, H. M. Antia, et al. 2017, "Seismic measurement of the locations of the base of convection zone and helium ionization zone for stars in the *Kepler* seismic LEGACY sample", ApJ, 837, 47 (citations: 36)
18. V. Silva Aguirre, M. N. Lund, H. M. Antia, …, K. Verma, et al. 2017, "Standing on the shoulders of dwarfs: the *Kepler* asteroseismic LEGACY sample. II. radii, masses, and ages", ApJ, 835, 173 (citations: 176)

19. M. N. Lund, V. Silva Aguirre, G. R. Davies, …, K. Verma, et al. 2017, "Standing on the shoulders of dwarfs: the *Kepler* asteroseismic LEGACY sample. I. oscillation mode parameters", ApJ, 835, 172 (citations: 145)
20. K. Verma, S. Hanasoge, J. Bhattacharya, et al. 2016, "Asteroseismic determination of fundamental parameters of Sun-like stars using multi-layered neural networks", MNRAS, 461, 4206 (citations: 14)
21. D. R. Reese, W. J. Chaplin, G. R. Davies, …, K. Verma, et al. 2016, "SpaceInn hare-and-hounds exercise: estimation of stellar properties using space-based asteroseismic data", A&A, 592, A14 (citations: 29)
22. W. J. Chaplin, M. N. Lund, R. Handberg, …, K. Verma, et al. 2015, "Asteroseismology of solar-type stars with *K2*: detection of oscillations in C1 data", PASP, 127, 1038 (citations: 29)
23. T. Appourchaux, H. M. Antia, W. H. Ball, …, K. Verma, et al. 2015, "A seismic and gravitationally bound double star observed by *Kepler*. Implication for the presence of a convective core", A&A, 582, A25 (citations: 36)
24. K. Verma, H. M. Antia, S. Basu, et al. 2014, "A theoretical study of acoustic glitches in low-mass main-sequence stars", ApJ, 794, 114 (citations: 22)
25. K. Verma, J. P. Faria, H. M. Antia, et al. 2014, "Asteroseismic estimate of helium abundance of a solar analog binary system", ApJ, 790, 138 (citations: 50)

Publications in peer-reviewed conference proceedings

1. K. Verma, J. P. Faria, H. M. Antia, et al. 2015, "Asteroseismic estimate of helium abundance of 16 Cyg A, B", EPJ Web of conferences, 101, 06066 (citations: 0)

Oral Scientific Communications

As of August 2022, I have presented **10** science talks, including **4** invited seminars, **1** invited talk and **5** contributed talks at various national and international universities/institutes and conferences/workshops.

1. Invited Talk titled "A comparison of the predictions of Auriga simulations with the APOKASC and *Gaia* data": *Chemical Evolution of Galaxies: the next 25 years* workshop, Sexten Center for Astrophysics, Sexten, Italy, January 11, 2020
2. Contributed Talk titled "Helium settling in F stars: Constraining turbulent mixing using observed signature of helium ionization": *TASC5/KASC12* workshop, MIT Cambridge, USA, July 23, 2019
3. Invited Seminar titled "Asteroseismology as a tool to study stellar physics and Galactic chemical evolution": Instituto de Astrofisica e Ciências do Espaço, Universidade do Porto, Portugal, July 10, 2019
4. Contributed Talk titled "Studying mixing in the outer layers using signatures of the acoustic glitches from *Kepler* data": *TASC4/KASC11* workshop, AU, Denmark, July 13, 2018
5. Contributed Talk titled "Constraining additional mixing processes using the observed helium signature in oscillation frequencies from *Kepler"*: *EWASS* special session, Liverpool, UK, April 3, 2018
6. Contributed Talk titled "Seismic estimate of the envelope helium abundance for stars in *Kepler* seismic LEGACY sample": *TASC3/KASC10* workshop, University of Birmingham, UK, July 19, 2017
7. Invited Seminar titled "Seismic study of Sun-like stars using glitch analysis and machine learning approaches": Indian Institute of Astrophysics, Bangalore, India, September 14, 2016
8. Invited Seminar titled "Asteroseismology of Sun-like main-sequence stars: inferences using acoustic glitch signatures and machine learning approaches": AU, Denmark, May 26, 2016
9. Contributed Talk titled "Asteroseismic inference of convection-zone depth and envelope helium abundance": *Advances in Seismology: A Dialogue Across Disciplines* conference, TIFR, India, December 9, 2015
10. Invited Seminar titled "Seismology of solar-like stars": Japan-Asia Youth Exchange Program in Science, Osaka University, Japan, November 30, 2015

Teaching and Supervision

- Advanced Stellar Structure and Evolution: Category: Invited Lecturer (3 hours); Level: Postgraduate; Semester: Autumn 2018; AU, Denmark
- Jonas Dornonville de la Cour: Category: Supervisor; Level: Undergraduate; Semester: Spring 2018; Thesis title: "Classifying Stellar Pulsations based on their Light Curves using Machine Learning"; AU, Denmark
- Astronomy & Astrophysics I: Category: Teaching Assistant; Level: Doctorate; Semester: Autumn 2014; TIFR, Mumbai, India
- Computational Methods II: Category: Teaching Assistant; Level: Doctorate; Semester: Spring 2014; TIFR, Mumbai, India
- Classical Electrodynamics I: Category: Teaching Assistant; Level: Doctorate; Semester: Autumn 2013; TIFR, Mumbai, India

Referee

- Referee scientific articles for The Astrophysical Journal (ApJ), Astronomy & Astrophysics (A&A) and Monthly Notices of the Royal Astronomical Society (MNRAS)
- Review observing proposals for the Canada-France-Hawaii Telescope (CFHT)

Membership of Societies, Consortia and Organizations

- Member of the International Astronomical Union (IAU), European Astronomical Society (EAS), Astronomical Society of India (ASI) and the United Science Foundation (USF)
- Member of a number of work packages within WP 121 (on Stellar Models), 124 (on Seismic Diagnostics) and 125 (on Determination of Stellar Parameters) in the framework of the PLATO Science Management (PSM).
- Member of the TESS Asteroseismic Science Operations Center (TASOC), as well as of the TESS Asteroseismic Science Consortium (TASC) Working Group 2 (on Oscillations in Solar-Type Stars) and 7 (on Red Giant Oscillations), and also part of the coordinated activity TESS Data for Asteroseismology
- Member of the *Kepler* Asteroseismic Science Operations Center (KASOC), as well as of the *Kepler* Asteroseismic Science Consortium (KASC) Working Group 1 (on Solar-Like Oscillations) and 8 (on RGB Oscillations)
- Member of the SONG Data Archive (SODA)

Attended Schools, Conferences and Workshops

1. MW-GAIA workshop on *Fundamental stellar parameters from asteroseismology: the connection with exoplanet studies in the era of Gaia*, AU, Denmark, June 13–15, 2022
2. PLATO WP12 HOW#2 virtual workshop (invited) on *Uncertainties in stellar properties determination*, April 12–15, 2021
3. PLATO WP12 HOW#1 virtual workshop (invited) on *the PLATO Stellar Analysis Pipeline: architecture, workflow, dataflow*, November 4–6, 2020
4. Workshop (invited) on *Chemical Evolution of Galaxies: the next 25 years*, Sexten Center for Astrophysics, Sexten, Italy, January 7–11, 2020
5. PLATO STESCI workshop III (invited), Residencia de Investigadores, Barcelona, Spain, November 19–22, 2019
6. TASC5/KASC12 workshop, Massachusetts Institute of Technology, Cambridge, USA, July 22–26, 2019
7. TASC4/KASC11 workshop on *First Light in a new Era of Astrophysics*, AU, Denmark, July 8–13, 2018

8. EWASS special session on *Open problems in modelling chemical element transport in stars*, Arena and Convention Centre, Liverpool, UK, April 3–6, 2018
9. Summer School on *Modules for Experiments in Stellar Astrophysics* (MESA), University of California, Santa Barbara, USA, August 14–18, 2017
10. TASC3/KASC10 workshop on *TESSting Stellar Astrophysics*, University of Birmingham, UK, July 16–21, 2017
11. Conference on *Advances in Seismology: A Dialogue Across Disciplines*, TIFR, Mumbai, India, December 7–11, 2015
12. Sakura Science, Japan-Asia Youth Exchange Program in Science, Osaka University, Japan, November 30–December 4, 2015
13. DWIH Indo-German Winter School on *Solar and stellar astrophysics*, TIFR, Mumbai, India, November 3–7, 2014
14. 24th Evry Schatzman School on *Asteroseismology and next generation stellar models*, Station Biologique de Roscoff, France, September 28–October 3, 2014
15. 9th Heidelberg Astronomy Summer School on *Frontiers of stellar structure and evolution*, Max-Planck-Institut für Astronomie, Heidelberg, Germany, September 22–27, 2014
16. 4th IIA-PennState School on *Astrostatistics*, Vainu Bappu Observatory, Indian Institute of Astrophysics, Bangalore, India, July 22–29, 2013
17. Winter School on *Astronomical and cosmological surveys*, TIFR, Mumbai, India, December 10–17, 2012

Technical Expertise/Skills

- Stellar evolution codes: Extensive experience in using the code *Modules for Experiments in Stellar Astrophysics* (MESA), while working knowledge of the *GARching STellar Evolution Code* (GARSTEC)
- Stellar pulsation codes: Extensive experience in using the *Aarhus adiabatic oscillation package* (ADIPLS), while working knowledge of the GYRE code
- Stellar model fitting code: Extensive experience as a developer and user of the *BAyesian STellar Algorithm* (BASTA) code
- Chemical evolution models: Moderate experience in using two-infall chemical evolution model code
- Cosmological zoom-in simulations: Working knowledge of the *Auriga* simulations
- Machine learning: Deep learning, a 5-course specialization by *deeplearning.ai* on Coursera. Specialization Certificate earned on February 18, 2018. Extensive experience using the machine learning platforms *Theano*, *TensorFlow* and *Keras*
- Bayesian statistics: Extensive experience in using the Markov Chain Monte Carlo (MCMC) ensemble sampler, *emcee*: The MCMC Hammer
- Programming languages: Extensive experience using *Fortran*, *Python* and *Bash Shell*, while working knowledge of *Mathematica*
- Operating systems: Extensive experience in using *Linux* and *Macintosh*, while working knowledge of *Windows.* Extensive experience in using high-performance computing facilities, and managing big data (~ terabyte)

Languages

- Hindi: Native proficiency
- English: Full professional proficiency