

**Dr. Kuldeep Verma PhD, MSc, BSc**  
Department of Physics and Astronomy  
Aarhus University  
Ny Munkegade 120, Building 1520  
DK-8000 Aarhus C  
Denmark

**DOB: February 1, 1989**  
E-mails: [kuldeep@phys.au.dk](mailto:kuldeep@phys.au.dk);  
[kuldeepv89@gmail.com](mailto:kuldeepv89@gmail.com)  
Mobile: +4560901202  
Skype: kuldeep.verma1989  
ORCID: 0000-0003-0970-6440

### **Overview**

I graduated by successfully defending my PhD thesis in October 2016 from Tata Institute of Fundamental Research, Mumbai, India. Since then I hold a contract as a postdoctoral research fellow at the Department of Physics and Astronomy, Aarhus University, Denmark. My main research interests are stellar astrophysics and Galactic archaeology. Specifically, I use spectroscopic data from the APOGEE survey and asteroseismic data from the CoRoT, *Kepler*/K2 and TESS satellites together with stellar evolution models and advanced statistical methods—such as machine learning and Bayesian analysis—to learn the structure and evolution of low-mass stars as well as to unveil the formation and evolution history of the Milky Way. As of September 2020, I am coauthor of 25 publications indexed in the SAO/NASA Astrophysics Data System (of which 7 peer-reviewed publications as first author).

I am a member of KASC (*Kepler* Asteroseismic Science Consortium) working groups on “Solar-like Oscillations” (WG1) and “RGB Oscillations” (WG8), and TASC (TESS Asteroseismic Science Consortium) working groups on “Oscillations in solar-type stars” (WG2) and “Red Giant oscillations” (WG7). I am a member of the coordinated activity on “TESS Data for Asteroseismology”. I am a member of the work package on “Theoretical Frequencies” (WP121 130) as well as an active participant in work packages on “Stellar Models” (WP121 000), “Determination of Stellar Parameters” (WP125 000) and “Acoustic Glitches” (WP124 300) within the framework of the PSM (PLATO Science Management). I have been an active contributor to the science output of the NASA *Kepler* and TESS space missions and am currently involved in the science preparatory work for the upcoming ESA PLATO mission. I am also a member of SODA (SONG Data Archive), IAU (International Astronomical Union) and EAS (European Astronomical Society).

I have received several national and international fellowships. I have presented numerous science talks at various national and international venues, and have significant teaching and supervision experience. I work as referee for scientific articles published in *ApJ* (The Astrophysical Journal) and act as reviewer for the observing proposals for CFHT (Canada-France-Hawaii Telescope).

### **Academic degrees**

27/07/2011 – 14/10/2016	<i>PhD in Physics</i> (Thesis submission: July 2016; Thesis defence: October 2016), Tata Institute of Fundamental Research, Mumbai, India Thesis adviser: Prof. H. M. Antia
15/07/2009 – 25/07/2011	<i>MSc in Physics (FGPA: 7.9/9.0, 1<sup>st</sup> class)</i> , Jawaharlal Nehru University, New Delhi, India
31/07/2006 – 08/06/2009	<i>BSc in Physics/Mathematics/Chemistry(minor) (Marks: 74.2%, 1<sup>st</sup> class)</i> , University of Allahabad, Allahabad, India

### **Academic/Research Positions**

01/11/2020 – 31/10/2022	<i>Postdoctoral Research Associate</i> , University of New South Wales, Sydney, Australia Group leader: Dr. D. Stello
01/10/2016 – 31/10/2020	<i>Postdoctoral Research Fellow</i> , Stellar Astrophysics Centre, Department of Physics and Astronomy, Aarhus University, Denmark Group leader: Dr. V. Silva Aguirre

### **Fellowships and Awards**

2020	Invited for interview for the prestigious <b>French CNES Postdoctoral Fellowship</b> (had to withdraw application at this stage because I already accepted another offer)
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- 2016 Offered **Postdoctoral Fellowship**, Instituto de Astrofísica e Ciências do Espaço, Universidade do Porto, Porto, Portugal
- 2014 **Ratanbai Jerajani Award**, for the best seminar in the area of Astronomy and Astrophysics, Tata Institute of Fundamental Research, Mumbai, India
- 2012 **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 September 2020, I am co-author of 25 publications indexed in the SAO/NASA Astrophysics Data System (H-index of 11 and a total of 511 citations). These include 18 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), 4 online data catalogs and 1 erratum. Altogether, I am first author of 7 publications.

### ***Publications in peer-reviewed scientific journals***

- 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: 1)
- 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: 5)
- 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: 6)
- 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  $\nu$  Indi”, **Nat Astron**, 4, 382 (citations: 7)
- K. Verma**, V. Silva Aguirre, 2019, “Helium settling in F stars: constraining turbulent mixing using the observed helium glitch signature”, **MNRAS**, 489, 1850 (citations: 5)
- 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: 34)
- K. Verma**, K. Raodeo, S. Basu, et al. 2019, “Helium abundance in a sample of cool stars: measurements from asteroseismology”, **MNRAS**, 483, 4678 (citations: 11)
- 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: 13)
- 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: 38)
- 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: 19)
- 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: 126)
- 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: 110)

**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: 9)

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: 21)

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: 25)

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: 27)

**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: 17)

**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: 34)

#### Publications in peer-reviewed conference proceedings

**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 September 2020, 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.

Invited Talk: *A comparison of the predictions of Auriga simulations with the APOKASC and Gaia data*; Chemical Evolution of Galaxies: the next 25 years workshop; Sixten Center for Astrophysics, Sixten, Italy, January 11, 2020

Contributed Talk: *Helium settling in F stars: Constraining turbulent mixing using observed signature of helium ionization*; TASC5/KASC12 workshop; MIT Cambridge, USA, July 23, 2019

Invited Seminar: *Asteroseismology as a tool to study stellar physics and Galactic chemical evolution*; Instituto de Astrofísica e Ciências do Espaço, Universidade do Porto, Porto, Portugal, July 10, 2019

Contributed Talk: *Studying mixing in the outer layers using signatures of the acoustic glitches from Kepler data*; TASC4/KASC11 workshop; Aarhus University, Denmark, July 13, 2018

Contributed Talk: *Constraining additional mixing processes using the observed helium signature in oscillation frequencies from Kepler*; EWASS special session; Liverpool, UK, April 3, 2018

Contributed Talk: *Seismic estimate of the envelope helium abundance for stars in Kepler seismic LEGACY sample*; TASC3/KASC10 workshop; University of Birmingham, UK, July 19, 2017

Invited Seminar: *Seismic study of Sun-like stars using glitch analysis and machine learning approaches*; Indian Institute of Astrophysics, Bangalore, India, September 14, 2016

Invited Seminar: *Asteroseismology of Sun-like main-sequence stars: inferences using acoustic glitch signatures and machine learning approaches*; Stellar Astrophysics Centre, Aarhus University, Denmark, May 26, 2016

Contributed Talk: *Asteroseismic inference of convection-zone depth and envelope helium abundance*; Advances in Seismology: A Dialogue Across Disciplines conference; Tata Institute of Fundamental Research, Mumbai, India, December 9, 2015

Invited Seminar: Seismology of solar-like stars; Japan-Asia Youth Exchange Program in Science; Osaka University, Japan, November 30, 2015

### ***Teaching and Supervision***

Jonas Dornonville de la Cour: **Final year undergraduate student** (Spring semester 2018); Thesis title: *Classifying Stellar Pulsations based on their Light Curves using Machine Learning*; Co-supervisor: Dr. Mikkel N. Lund (Aarhus University)

Advanced Stellar Evolution: Category: **Invited lecturer (1 week)**, Level: **Postgraduate**, Semester: **Autumn 2018**, Postgraduate Degree Course, Aarhus University, Denmark

Computational Methods II: Category: **Teaching Assistant**, Level: **Doctorate**, Semester: **Spring 2014**, Doctoral Programme in Physics, Tata Institute of Fundamental Research, Mumbai, India

Astronomy & Astrophysics I: Category: **Teaching Assistant**, Level: **Doctorate**, Semester: **Autumn 2014**, Doctoral Programme in Physics, Tata Institute of Fundamental Research, Mumbai, India

Classical Electrodynamics I: Category: **Teaching Assistant**, Level: **Doctorate**, Semester: **Autumn 2013**, Doctoral Programme in Physics, Tata Institute of Fundamental Research, Mumbai, India

### ***Referee***

Referee scientific articles for the Astrophysical Journal

Referee observing proposals for the Canada-France-Hawaii Telescope (CFHT)

### ***Membership of Societies, Consortia and Organizations***

Member of the International Astronomical Union (IAU)

Member of the European Astronomical Society (EAS)

Member of the Work Package 121 130 (“Theoretical Frequencies”) as well as an active participant in the Work Packages 121 000 (“Stellar Models”), 125 000 (“Determination of Stellar Parameters”), and 124 300 (“Acoustic Glitches”) within the framework of the PLATO Science Management (PSM)

Member of the SONG Data Archive (SODA)

Member of the TESS Asteroseismic Science Operations Center (TASOC)

Member of the TESS Asteroseismic Science Consortium (TASC) Working Group 2 (“Oscillations in solar-type stars”) and Working Group 7 (“Red Giant oscillations”), and also part of coordinated activity “TESS Data for Asteroseismology”

Member of the *Kepler* Asteroseismic Science Operations Center (KASOC)

Member of the *Kepler* Asteroseismic Science Consortium (KASC) Working Group 1 (“Solar-like Oscillations”) and Working Group 8 (“RGB oscillations”)

### ***Attended Schools, Conferences and Workshops***

Chemical Evolution of Galaxies: the next 25 years workshop: Sixten Center for Astrophysics, Sixten, Italy, January 7–11, 2020

PLATO STESCI workshop III: Residencia de Investigadores, Barcelona, Spain, November 19–22, 2019

TASC5/KASC12 workshop: Massachusetts Institute of Technology, Cambridge, USA, July 22–26, 2019

TASC4/KASC11 workshop: *First Light in a new Era of Astrophysics*, Aarhus University, Denmark, July 8–13, 2018

EWASS special session: *Open problems in modelling chemical element transport in stars*, Arena and Convention Centre, Liverpool, UK, April 3–6, 2018

Summer School: *Modules for Experiments in Stellar Astrophysics (MESA)*, University of California, Santa Barbara, USA, August 14–18, 2017

TASC3/KASC10 workshop: *TESSing Stellar Astrophysics*, University of Birmingham, UK, July 16–21, 2017

Conference: *Advances in Seismology: A Dialogue Across Disciplines*, Tata Institute of Fundamental Research, Mumbai, India, December 7–11, 2015

Sakura Science: Japan-Asia Youth Exchange Program in Science, Osaka University, Japan, November 30–December 4, 2015

DWIH Indo-German Winter School: *Solar and stellar astrophysics*, Tata Institute of Fundamental Research, Mumbai, India, November 3–7, 2014

24<sup>th</sup> Evry Schatzman School: *Asteroseismology and next generation stellar models*, Station Biologique de Roscoff, France, September 28–October 3, 2014

9<sup>th</sup> Heidelberg Astronomy Summer School: *Frontiers of stellar structure and evolution*, Max-Planck-Institut für Astronomie, Heidelberg, Germany, September 22–27, 2014

4<sup>th</sup> IIA-PennState School: *Astrostatistics*, Vainu Bappu Observatory, Indian Institute of Astrophysics, Bangalore, India, July 22–29, 2013

Winter School: *Astronomical and cosmological surveys*, Tata Institute of Fundamental Research, Mumbai, India, December 10–17, 2012

### **Technical Expertise/Skills**

Extensive experience using the stellar evolution code *Modules for Experiments in Stellar Astrophysics (MESA)* and working knowledge of the *Garching Stellar Evolution Code (GARSTEC)*

Extensive experience using the stellar pulsation code *Aarhus adiabatic pulsation package (ADIPLS)* and working experience of the code **GYRE**

Extensive experience using and further developing the stellar model fitting code *Bayesian Stellar Algorithm (BASTA)*

Moderate experience in chemical evolution (two-infall) modelling

**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**

Extensive experience using the *Markov Chain Monte Carlo ensemble sampler (emcee: The MCMC Hammer)*

Extensive experience using computer operating systems **Linux** and **Macintosh** and working knowledge of **Windows**

Extensive experience using *High-Performance Computing (HPC)* facilities and managing **big data (~TB)**

Extensive experience using programming languages **Fortran**, **Python** and **Bash Shell** and working knowledge of **Mathematica**

***Languages***

Hindi: Native proficiency

English: Full professional proficiency