



# Dr. Ajey Kumar Tiwari

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## Personal Details

DOB January 1, 1982  
Father's Name Mr. Ved Prakash Tiwari  
Address House N. 12, Ward No. 2, C. C. Road, Deoria Ramnath (West), Deoria-274001 (U. P.)

## Current Position

August 2019 onwards Assistant Professor, Digvijai Nath Post Graduate College, Gorakhpur.

## Teaching Experience

July 2018 onwards Guest Faculty, Madan Mohan Malaviya University of Technology, Gorakhpur.

## Education

2015–2018 **Post Doctoral Fellow**, *School of Mathematics, Statistics and Computer Science, University of Kwazulu-Natal, Durban, South Africa.*  
2008–2014 **Ph. D.**, *Motilal Nehru National Institute of Technology, Allahabad.*  
2001–2003 **M. Sc.**, *D. D. U. Gorakhpur University, Gorakhpur, 67.2%.*  
1998–2001 **B. Sc.**, *D. D. U. Gorakhpur University, Gorakhpur, 64.0%.*  
1996–1998 **Senior Secondary**, *Maharaja Agarsen Inter College, Deoria, 60.0% (U. P. Board).*  
1995–1996 **Secondary**, *Saraswati Sr. Sec. Vidya Mandir, Deoria, 62.8% (C. B. S. E. Board).*

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## Ph. D. Thesis

- Title** **Symmetry and Integrability aspects of a class of nonlinear dynamical systems**
- Supervisor** Dr. S. N. Pandey, Associate Professor, Motilal Nehru National Institute of Technology, Allahabad.
- Description** Nonlinear dynamics is an interdisciplinary branch of science which is concerned with the study of various disciplines, namely physics, hydrodynamics, mathematics, etc. The mathematical formulation of the various nonlinear systems encountered in different fields results in the form of nonlinear ordinary differential equations, partial differential equations and so on. To extract information about the physical system one needs to solve the evolution equation of the underlying system. As there is no standard method to solve nonlinear differential equations, one finds that only very few of them are exactly solvable while a majority of them are not. On the basis of this the nonlinear systems are further classified as integrable and nonintegrable systems. During the - past few decades there has been a resurgence of interest in identifying and classifying integrable systems as they are of very much importance due to their regular and predictive behaviour. Though there is no precise definition of integrability, there exists systematic procedures like Lie point symmetry method, Prellé-Singer procedure, factorization method and so on to identify such integrable systems. Thus it will be quite interesting to look for the existence of the new integrable systems in a systematic way and to study the underlying integrability properties and their dynamical properties. In particular, symmetry and invariance properties underlying a given dynamical system can play a crucial role in identifying integrability property as symmetries are associated with integrals of motion. This forms the core subject of the thesis.

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## Research plans, interests and goals

The core of Ph. D. thesis has been extended and applied by myself in the area of Astrophysics and General Relativity during my post-doctoral research which resulted in finding new exact models for radiating stars using Lie point symmetries and its extensions. This area is vast and finding new exact solutions for radiating stars is still a challenging problem under various boundary conditions. Hence, my plan is to further investigate radiating stars under various conditions and to explore the exact radiating stars and to relate it to the experimental data for better understanding. Lie symmetry method and its extensions will be the main tools to achieve this goal.

In addition to this, I am also interested in analyzing various biological systems with the help of Lie point symmetries and its extensions. Since the model of biological systems generally results in nonlinear differential equations which is studied by numerical methods and hence only an approximate behaviour of the system can be obtained. This motivates to look for biological systems from analytical method, for example Lie symmetry method, so that a complete description of the system can be obtained.

## Research Experience

10 years research experience in theoretical nonlinear dynamics in integrable systems. In particular, I am working on the symmetries, integrability and Non-standard Hamiltonian of nonlinear differential equations arising in the various areas of physical interest including Astro physics and General Relativity.

## Reviewer in Journal(s)

**Name of the Journal: Quaestiones Mathematicae**

ISSN/E-ISSN Number: 16073606/1727933X

Source: WoS and Scopus

Publisher: Natl Inquiry Services Centre Pty Ltd, South Africa

**Name of the Journal: European Physical Journal C**

ISSN/E-ISSN Number: 1434-6044 (Print)/ 1434-6052 (Online)

Publisher: Springer

## Fellowships

**July 2015 onwards, *Post Doctoral Fellowship***, School of Mathematics, Statistics and Computer Science, University of Kwazulu-Natal, Durban-4000, South Africa.

**July 2014 - June 2015, *Research Associate***, Centre for Nonlinear Dynamics, Bharathidasan University, Trichy-620024, Tamilnadu.

**January 2013 - June 2013, *Visiting Scientist***, Centre for Nonlinear Dynamics, Bharathidasan University, Trichy-620024, Tamilnadu.

**May 2012 - October 2012, *Visiting Scientist***, Centre for Nonlinear Dynamics, Bharathidasan University, Trichy-620024, Tamilnadu.

**July 2010 - February 2012, *Senior Research Fellow***, Motilal Nehru National Institute of Technology, Allahabad-211004.

**January 2009 - June 2010, *Junior Research Fellow***, Motilal Nehru National Institute of Technology, Allahabad-211004.

## Books/Chapters

- 1 A chapter on Central Forces (Unit 7) in SLM (Study Learning Material(2020-21)) for U. P. Rajarshi Tandon Open University, Prayagraj, India .

## Publications

- 1 M. Lakshmanan V. K. Chandrasekar, **A. K. Tiwari**, S. N. Pandey, M. Senthilvelan, Response to Comment on “Classification of Lie point symmetries for quadratic Liénard type equation  $\ddot{x} + f(x)\dot{x}^2 + g(x) = 0$ ” J. of Mathematical Physics **61** (2020) 044102.
- 2 **A. K. Tiwari** and S. D. Maharaj, Static spherical metrics: a geometrical approach, Class. Quantum Grav. **34** (2017) 155009.
- 3 **A. K. Tiwari** and S. D. Maharaj, A new class of geodesic radiating models, Eur. Phys. J. Plus **132** (2017) 493.
- 4 S. D. Maharaj, **A. K. Tiwari**, R. Mohanlal and R. Narain, Riccati equations for bounded radiating systems, J. of Mathematical Physics **57** (2016) 092501.
- 5 R. Mohanlal, S. D. Maharaj, **A. K. Tiwari**, and R. Narain, Radiating stars with exponential Lie symmetries, Gen Relativ Gravit **48** (2016) 87.
- 6 **A. K. Tiwari**, S. N. Pandey, V. K. Chandrasekar, M. Senthilvelan and M. Lakshmanan, The inverse problem of a mixed Liénard type nonlinear oscillator equation from symmetry perspective, Acta Mechanica **227** (2016) 2039.
- 7 **A. K. Tiwari**, S. N. Pandey, M. Senthilvelan and M. Lakshmanan, Lie point symmetries classification of the mixed Liénard type equation, Nonlinear Dynamics **82** (2015) 1953.
- 8 **A. K. Tiwari**, A. Durga Devi, R. Gladwin Pradeep and V. K. Chandrasekar, Isochronous Liénard type nonlinear oscillators of arbitrary dimensions, Pragma **85** (2015) 789.
- 9 **A. K. Tiwari**, S. N. Pandey, V. K. Chandrasekar and M. Lakshmanan, Factorization technique and isochronous condition for coupled quadratic and mixed Liénard-type nonlinear systems, Applied Mathematics and Computation **252** (2015) 457.
- 10 **A. K. Tiwari**, S. N. Pandey, M. Senthilvelan and M. Lakshmanan, Erratum: Classification of Lie point symmetries for quadratic Liénard type equation  $\ddot{x} + f(x)\dot{x}^2 + g(x) = 0$ , J. of Mathematical Physics **55** (2014) 059901.
- 11 **A. K. Tiwari**, S. N. Pandey, M. Senthilvelan and M. Lakshmanan, Classification of Lie point symmetries for quadratic Liénard type equation  $\ddot{x} + f(x)\dot{x}^2 + g(x) = 0$ , J. of Mathematical Physics **54** (2014) 053506.

## Schools/Workshop/Conference/Seminar

- 1 Workshop on “How to Develop Effective E-Learning Content” organized by Department of Computer Science and IQAC, Digvijay Nath Post Graduate College, Gorakhpur (U.P.), India during June 08-14, 2020.
- 2 National Webinar on “Implementation of National Education Policy-2020 in Higher Education” held at Department of Physics, Digvijai Nath Post Graduate College, Gorakhpur (U.P.), India during September 07-08, 2020.
- 3 International Webinar on “SURVIVAL WITH COVID-19” held at Department of Physics, Digvijai Nath Post Graduate College, Gorakhpur (U.P.), India during June 23-25, 2020.
- 4 International Webinar on “Covid-19: Challenges and Perspectives” organized by Department of Botany, Digvijainath PG College, Gorakhpur, India on June 3, 2020.
- 5 Recent Developments in Gravity during 13-17, 2017 held at Alpine Heath Resort in the Northern Drakensburg, South Africa.
- 6 59th Annual Congress of the South African Mathematical Society during November 2-4, 2016 held at University of the Western Cape, South Africa.
- 7 5th Ulyanovsk International School-Seminar on Theoretical and Observational Cosmology “UISS-2016” organized by Russian Gravitational Society and Ilya Ulyanov State Pedagogical University, Russia.
- 8 Symposium on “Partial Differential Equations and Their Applications” during March 9-11, 2016 held at Stellenbosch South Africa.
- 9 58th Annual Congress of the South African Mathematics Society “SAMS” during November 4-6, 2015 held at the University of the Witwatersrand, Johannesburg, South Africa.
- 10 South African Gravity Society “SAGS” meeting during August 31 to September 02, 2015 held at Rhodes University, Grahamstown South Africa.
- 11 Conference on “Analysis and Differential Equations with Applications to Natural Sciences” during July 12-16, 2015 held at Salt Rock, KwaZulu Natal South Africa.
- 12 Science Academies’ Refresher Course on “Classical Mechanics and Electromagnetism” during December 08-20, 2014 held at the Department of Physics, Sri Dharmasthala Manjunatheshwara College, Ujire, Karnataka.
- 13 NMI Workshop on Nonlinear Integrable Systems and their Applications during February 24 - March 01, 2014 held at the Centre for Nonlinear Dynamics, School of Physics, Bharathidasan University Tiruchirapalli-620024, Tamilnadu.
- 14 Science Academies’ Lecture Workshop on Nonlinear Physics during 23-25, January, 2014 held at Bishop Heber College, Tiruchirapalli-620024, Tamilnadu.

- 15 Sixth National Conference on Nonlinear Systems and Dynamics during 27-30, January, 2011 held at the Centre for Nonlinear Dynamics, School of Physics, Bharathidasan University Tiruchirapalli-620024, Tamilnadu.
- 16 DST-SERC school on Nonlinear Dynamics (Specialization: Integrable Systems) during 04-26, January 2011 held at the Centre for Nonlinear Dynamics, School of Physics, Bharathidasan University Tiruchirapalli-620024, Tamilnadu.
- 17 National Level TPSC Workshop on Recent Advancements in Theoretical Physics and Quantum Computation during 17-19, March 2009 held at Department of Physics, N G M College, Pollachi-620024, Tamilnadu.
- 18 National Seminar on Nonlinear Electronics and Spintronics during 20-21, march, 2009 held at the Centre for Nonlinear Dynamics, School of Physics, Bharathidasan University Tiruchirapalli-620024, Tamilnadu.
- 19 Summer School on Introductory Astronomy & Astro Physics during June 3-8, 2002 held at Manora Peak, Nanital.

## Technical skills

Proficiency Mathematica, Maple, Linux, MS office.

## Languages

Mother-tongue	<b>Hindi</b>	<i>Fluent</i>
English	<b>Proficient</b>	<i>Fluent</i>

## Courses currently teaching

Physics	Classical Mechanics, Electromagnetism, Electronics, Optics, Quantum Mechanics, Mathematical Physics
Applied Maths	Mathematical Methods, Nonlinear Dynamics, Differential Equations