



Welcome! You have landed on my intro page...

My flavor: a blend of science and literature...

Je m'appelle: **MURLI MANOHAR VERMA**
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Present Position: PROFESSOR of Physics

The World Academy of Sciences: TWAS - UNESCO Associate (2023-2026)
Instituto de Astronomia Teorica y Experimental, Cordoba.

Visiting Scientist: CERN, Geneva (Theoretical Physics Division) 2014-2020, 2020-2023.
Visiting Associate: Inter University Centre for Astronomy and Astrophysics, (IUCAA), Pune 2016-25.
Visiting Professor /Fellow/Scientist: Kavli Institute of Physics and Mathematics of the Universe, University of Tokyo, 2018.,
Institute of High Energy Physics, Beijing, 2018.
The Abdus Salam International Centre for Theoretical Physics (ICTP), Trieste, 2018, 2019.
Max Planck Institute for Astrophysics, Garching, 2019.

Affiliate: Minkowski Institute for Foundational Studies, Montreal, 2020..contd.

Member: International Astronomical Union (IAU)

- Member of Division C Education, Outreach and Heritage.
- Member of Division D High Energy Phenomena and Fundamental Physics.
- Member of Division J Galaxies and Cosmology.
- Member of Commission C1 Astronomy Education and Development.
- Member of Commission C2 Communicating Astronomy with the Public.
- Member of Commission C4 World Heritage and Astronomy.
- Member of Commission D1 Gravitational Wave Astrophysics.
- Member of Inter-Commission C1-C3-C4 WG Archaeoastronomy and Astronomy in Culture.
- Member of Division D Working Group on Supernovae.

Teaching/Research Teaching: more than 29 years, Research: 36 years

EDUCATION AND QUALIFICATION:

- Doctoral: D. Phil. on "Cosmological models and the evolution of the universe", University of Allahabad, India.
- Masters: M.Sc.(Physics), University of Allahabad, India.
- MERIT GRADE/DIV: FIRST throughout.
- Language Proficiency: ENGLISH, FRENCH, URDU (Native language: HINDI).
- Along with various Scholarships: National Merit Scholarship/ CSIR-UGC JRF/SRF etc.

UGC MAJOR RESEARCH PROJECT: Principal Investigator on "a comparative study of cosmological constant and the dynamical dark energy". 2010-2013. (University Grants Commission, New Delhi)

I am currently giving lectures on Classical Electrodynamics to Master's students...

(sharing the excitement of the relativistic covariance of Maxwell's electrodynamics as a precursor to the field theory with h going to 1). *(Links to some of my live streamed video lectures can be found at the end below.)*

And two courses on *Mechanics and Wave Motion* and *Elements of Relativistic and Classical Mechanics* to undergrads, along with interactive lab sessions at both levels. Plus, PhD coursework lectures on General Relativity and Cosmology (Large scale structure of the Universe, CMBR and the like).

"If you want to find the secrets of the universe, think in terms of energy, frequency and vibration" --- Nikola Tesla)

I am interested in learning and understanding :

- How the universe began, (if at all it so did!) and its evolution.
- How classical gravity emerges from a more fundamental quantum theory.
- Gravity of gravity *vis a vis* basic interactions in Physics.
- Connections between space and time, and possibly higher dimensions.
- Popperian paradigm of science and nature of reality.

My current research is focused to answer what the nature of dark matter and dark energy in the universe is, hoping to build an alternative theory of gravity to account for these unknown components. Thus, recently,

1. We have proposed a modified version of Einstein's gravity in form of $f(R)$ gravity that doesn't need, at all, dark matter in form of particles, or dark energy physicists are hunting for. Our claim is that the observed effects can be reproduced by such modified theory and you need not invoke any exotic form of matter or energy to do that!
2. In addition, through a non-conventional stride, we have also calculated amplitude and other dynamical characteristics of the possible gravitational waves (GWs) in high energy particle colliders like LHC, or future CEPC or FCC, in tune with our earlier claims (2014 onwards). We are developing experimental procedures at the LHC, and if supported by future experiments, these signatures are expected to be radically different from those of the primordial inflationary, or the recently observed astrophysical, GWs. They would also show the scalar modes of polarization that may be detected by future LIGO-like detectors.

1. SOME OF THE MOST RECENT RESEARCH PAPERS PUBLISHED:

- (i) 'Effect of the modified gravity on the large-scale structure formation', *Astrophys. J. (ApJ)*, **934** (1), 13, (2022).
- (ii) 'Unified $f(R)$ gravity at local scales', *Eur. Phys. J. C (EPJC)*, **82**, 400, (2022).
- (iii) 'Power-law Inflation in the $f(R)$ Gravity', *Astrophys. J. (ApJ)*, **926** (1), 29, (2022).
- (iv) 'Light deflection angle through velocity profile of galaxies in $f(R)$ model', *Eur. Phys. J. C (EPJC)*, **81**, 109, (2021).
- (v) 'Extended galactic rotational velocity profiles in $f(R)$ gravity background', *Eur. Phys. J. C (EPJC)*, **80**, 619, (2020).
- (vi) 'Dark matter as scalaron in $f(R)$ gravity models', *J. Cosmol. Astropart. Phys. (JCAP)*, **10**, 052, (2019).

- (vii) **'Dynamics of $f(R)$ gravity models and asymmetry of time'**, Int. J. Mod. Phys. D (IJMPD), **27**, 1850002, (2018).
- (viii) **'Cosmological wheel of time: a classical perspective of $f(R)$ gravity'**, Int. J. Mod. Phys. D (IJMPD), **26**, 1750183, (2017).
- (ix) **'Observational role of dark matter in $f(R)$ models for structure formation'**, Int. J. Mod. Phys. (CS), **46**, 1860045, (2018), presented at the 21st Particles and Nuclei International Conference, September 1-5, 2017, Beijing, China.
- (x) **'On a possibility of the gravitational wave detection at the high energy colliders'**, Int. J. Mod. Phys. (CS), **46**, 1860059, (2018), presented at the 21st Particles and Nuclei International Conference, September 1-5, 2017, Beijing, China.
- (xi) **'Closed loops of time in $f(R)$ gravity background'**: presented at the 29th IAGRG meeting on Era of gravitational waves, May 18-20, 2017, IIT, Guwahati, India.
- (xii) **'Emergence of wheel (and not the arrow) of time from cosmic structures'**: presented at the 6th Subaru Intl Conference: Panoramas of Evolving Cosmos, Nov 28-Dec 2, 2016, Hiroshima, Japan.
- (xiii) **'A single Higgs-like scalar field and the role of late time acceleration in BICEP2 data'**, Nucl and Particle Phys Proceedings 273, 2360 (2016), 37th International Conference on High Energy Physics (ICHEP), July 2-9, 2014, **Valencia**, Spain.
- (xiv) **'Dynamics of interacting quintessence'**, Eur. Phys. J. C. (EPJC) **75**, 395 (2015).
- (xv) **'Thermodynamic origin of the arrow of time in $f(R)$ gravity'**, National Conference on CICAHEP, Dibrugarh proceedings, **01**, 68, (2015).
- (xvi) **'Thermodynamics of interacting tachyonic scalar field'**, National Conference on CICAHEP, Dibrugarh proceedings, **01**, 73, (2015).
- (xvii) **'The BICEP2 data and a single Higgs-like interacting scalar field'**, Int. J. Mod. Phys. D (IJMPD), **23 (9)**, 1450075 (2014).
- (xviii) **'Cosmic expansion driven by real scalar field for different forms of potential'**, Astrophys Space Sci. **350**, 381. (2014).
- (xix) **'Thermodynamic origin of interaction in the cosmological tachyonic field'**, National Conference on Contemporary Issues in HEP and Cosmology (NC--HEPC), February 12-14, 2013, **Guwahati**, India. J. Phys.: Conf. Ser. **481**, 012015 (2014).
- (xx) **'Impact of dark sector on cosmic microwave background radiation'**, National Conference on Contemporary Issues in HEP and Cosmology (NC--HEPC), February 12-14, 2013, **Guwahati**, India. J. Phys.: Conf. Ser. **481**, 012011 (2014).
- (xxi) **'Observational constraints on modified Chaplygin gas in Horava-Lifshitz gravity with dark radiation'**, Pramana J. Physics **81**, 4, 691 (2013).
- (xxii) **'The alternative geometries : The non-constant cosmological constant'**, International Conference on Physical Interpretations of Relativity Theory (PIRT), July 1-4, 2013, Bauman Moscow State University, **Moscow**, Russia.
- (xxiii) **'Time symmetry in the endless universe'** Advanced Studies Institute, Spin and Symmetries (SPIN-PRAHA), July 7-13, 2013, Charles University, **Prague**, Czech Republic.
- (xxiv) **'Shifted cosmological parameter and shifted dust matter in a two-phase tachyonic field universe'**, Astrophys Space Sci. **344**, 505 (2013).
- (xxv) **'A tachyonic scalar field with mutually interacting components'**, Int Jour of Theor Phys, **51** 8 2370 (2012).

(xxvi) **'Evolution of the universe with interaction among the three-component tachyonic scalar field'** –(talk B6, session E)International Conference on Astrophysics and Cosmology (ICAC) March 19-21, 2012, **Kathmandu**, Nepal.

(xxvii) **'The equation of state parameters of cosmological tachyonic field components'**— Les Recontres du Vietnam, 10th International Conference on Gravitation, Astrophysics and Cosmology (ICGAC), December 17-22, 2011, **Quy-Nhon**, Vietnam.

(xxviii) **'A new mechanism for dark matter generation from an interacting cosmological constant'**— presented at 25th TEXAS Symposium on Relativistic Astrophysics, December 6-10, 2010, **Heidelberg**, Germany.(Proceedings of Sciences, 218, 2010, SISSA, Italy). Eds. Frank M. Rieger, Christopher vanEldik and Werner Hofmann.

(xxix) **'Dark energy as a manifestation of the non-constant cosmological constant'**-- Astrophys Space Sciences, **330** 101 (2010).

(xxx) **'Non-Machian singularity and inconsistent equivalence principle'** -- (UNESCO, Paris). Proceedings of Marcel Grossman Meeting 12, July 12-18, 2009, **1420**, World Scientific. Eds. T. Damour and R. Jantzen.

(xxxi) **'On evolution of the interacting cosmological constant'**- (Institute Henri Poincare, Paris.) Proceedings of Marcel Grossman Meeting 12, July 12-18, 2009, **1325**, World Scientific. Eds. T. Damour and R. Jantzen.

- **Internal reports : 6 ... 2 ICTP pre-prints (IC/2009041, IC/2009063,) 3 Student Learning Objectives: California State University, Long Beach Collaboration.**

(i)**'Avoidance of singularity and global non-conservation of energy in general relativity'**- (ICTP Pre-print IC/2009041, arxiv:gr-qc/0906.4933), The Abdus Salam International Centre for Theoretical Physics Trieste, Italy.

(ii)**'The interacting and non-constant cosmological constant'**- (ICTP Pre-print IC/2009063, arxiv: 0908.2303), The Abdus Salam International Centre for Theoretical Physics Trieste, Italy.

(iii)**3 Teaching Commons Reports in Science (California State University Long Beach Collaboration)**

(iv) Comments on **"Is dark energy really a mystery?"**Eugenio Bianchi, Carlo Rovelli & Rocky Kolb, *Nature*, 466,321-322 (15 July 2010).

(2) LECTURES DELIVERED by me: (about 130 in COLLOQUIA/ SCHOOLS/ CONFERENCES/ WORKSHOPS etc.) across the world, e.g., including

- **CERN : Theory-PH Division COSMO-Coffee Seminar on "A single Higgs-like scalar field, dark matter and gravitational waves: a look-out at the LHC"**, June 3, 2019.
- **Max Planck Institute for Astrophysics, Garching, Germany**, June 10, 2019,
- **Centre for Future High Energy Physics Colloquium, Beijing: 2018.**
- **APC Lab, Paris University VIA Seminar : "Dark side of modified gravity"**. Nov 16, 2018.
- **Astronomy Institute "Anton Pannekoek", Amsterdam University Colloquium on "Cosmological constant: a new manifestation of the accelerating universe"** on July 20, 2009; at **High Energy Physics group, ICTP, Trieste, Italy, Marcel Grossman Meeting 12, UNESCO, Paris, July 12-18, 2009** etc.

(3) UGC SAP Visiting Fellow: Vidyasagar University, Midnapore, WB,(2016).

(4) Books in progress :"Theory of Classical Fields"(Springer, Heidelberg, under process). A translation into Hindi of "The Seven Wonders of the Cosmos" also in progress.

(5) Monographs reviewed: e.g., "The Future of Theoretical Physics and Cosmology: Celebrating Stephen Hawking's Contributions to Physics", eds: Gibbons, Shellard and Rankin, *Contemp Phys*, 52:4, 380.

<https://drive.google.com/file/d/1Pw33zb4ITdPfzAFbw6PoMz3SLbbiAP8/view>

(6) Popular Science Articles:about 50 published in various magazines in English and Hindi (e.g., "A Random Walk through Champs Elysees", "Space: The Final Frontiers", "The Fall of a Meteor", "Are We alone in the Universe?", "The Rights and Wrongs of the Blind Watchers", "Hello, Aliens! Are you listening?", "On the Wings of Spacetime: Electromagnetic and Gravitational Waves ", etc.).See, e.g., https://drive.google.com/file/d/1ceUvNRw_cSSQZREO7n8hydZl4SNCGY9j/view

(7) Editor-in-Chief:"Prospice", "Samavet" and "Dishabodh" periodical magazines at the University of Allahabad for 2 years.

(8) **Popular Science Community Work:** Starting off with Total solar eclipse 24 Oct.1995, Shoemaker-Levy colliding with Jupiter, Transit of Venus, Alignment of planets, Saturn Observation Campaign(European Space Agency, Deep Impact Discovery Mission to Comet Tempel-1 under NASA (USA) 2003. Adler Planetarium Chicago, supported by KICP. Member of **organizing committee** of a Film Fest on science under NCZCC Allahabad, apart from organizing number of scientific activities for students in rural/urban areas, recently those supported by *Anveshika* IITK, SciPOP, IUCAA Pune, *Swaraj Vidyapeeth*, Allahabad and Regional Science City, Lucknow. Delivered about 25 **All India Radio and TV** talks on several topics, most recently on *Chandrayaan 3* mission, *Aditya L1* mission. Contributed to '*Vigyan se aadhyatm tak*' a film documentary. A link to my latest Radio interview is at

https://drive.google.com/file/d/1oRhyht7RhNDIqPJnqead9_DdJb_EUr43/view

(9) **Member:** International Astronomical Union (**IAU**), International Society for General Relativity and Gravitation (**ISGRG**), **Life Member:** Indian Association for General Relativity and Gravitation (**IAGRG**), Astronomical Society of India (**ASI**), Indian Association of Physics Teachers (**IAPT**), Material Research Society of India (**MRSI**), Affiliate of Institute of Nuclear Theory (**INT**), University of Washington, USA.

(10) **Referee to journals:** Astrophys J, JCAP, Phys Rev D, Euro Phys J C, IJMPD, Class and Quant Grav, Gen Rel and Grav, Modern Phys Lett A.

(11) **Other Memberships: University Bodies:** Executive Council, University of Lucknow, Academic Council, Faculty Board, Board of Studies, Admission Committees etc. **Member:** Advisory Committee of National Council of Science Museums, Regional Science City, Lucknow, **Member:** Multimedia Educational Resource for Learning and Online Training, **California State University, Long Beach, Saturn Observation Campaign** (Jet Propulsion Lab, NASA) etc.

(12) **Links to some of my recently live streamed video lectures for students:**

https://drive.google.com/file/d/1T-4Cv6RKf5ZQPAafjmVYHczvAVoX8rdj/view?usp=drive_web (13)

<https://drive.google.com/file/d/1ele9nW3AR7wAggjAFwt9aMBhhs-iWFks/view> (10)

<https://drive.google.com/file/d/1hTaomhnpfAMyNkckwRcwnqIHYRR8L70D/view> (6)

https://drive.google.com/file/d/1bR-94snmePzEaX7IK801W1ELt82XJb9U/view?usp=drive_web (2/2)

https://drive.google.com/file/d/1ILPu8uc1GGCqXWTtOHYj-Ir60l6hCZPI/view?usp=drive_web (2/1)

<https://drive.google.com/file/d/1kmG2xowHcKdAlq2UNvHczFtSUgD63kMv/view> (1/2)

<https://drive.google.com/file/d/1lybwF8CDIV3DLwTYSIO9CiCIZjzMqERU/view> (1/1)