

Welcome ALL to First ANMitra lecture 2025

- 1. ANMitra's Views on Science –Religion Partition
Cartesian partition of 1660s and Tunnelling through it now
- 2. A Better mousetrap for Black Hole QNMs
- N.Panchapakesan
- University Of Delhi, Delhi
- April 14, 2025

Cartesian Partition

- Rene des Cartes, after whom Cartesian orthogonal coordinates are named suggested in mid 1660s that religion should not be part of science. Probably to make faster progress in Science.
- This in spite of views of Kepler and Newton that Natural Order and God play an important role in natural laws.
- ANMitra quotes G.Holton to say that “Theory vs Experimental Proof” is the basis of Scientific Method.
- This worked very well till 1900 for 250 years.
- The arrival of Relativity, which made Time relative and Quantum Mechanics, which made causality statistical and diluted Determinism changed the whole picture by 1930s. Participatory physics OR Effect of Measurement with “ h ” finite.

Relativity and Q Mechanics in 20th century

- Time is relative. Important if our velocity is comparable to that of light.
- Photon and later electron are both found to be Particles (localised) as well as Waves (Extensive). Like Atma and Paramatma in religion.
- Causality and Determinism both become Statistical. Individual event can not be predicted.
- Einstein thought QM is incomplete. Bohr with his 'Complementarity' argued that one can do no better.
- We still have no agreement.

Tao of Physics of Capra and resembling Eastern Mysticism

- F. Capra compared the universal and self interaction in Quantum Mechanics to Unity in the Universe experienced by Mystics.
- On that basis he thought Bootstrap theory should be correct.
- Unfortunately Physics moved to Quark Model as fundamental particles, though not observable individually.
- Maybe instead of Mysticism in Science, we need science in social science and in our lives which is full of emotions, Love, Compassion, Joy, Ecstasy.

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Distinction between Natural and Social Science and Scientific Temper

- Not many scientists believe that Science can explain values.
- Maybe we need a partition between Natural Science and social science .
- Ronald Searle, a Univ of Calif. Berkley, USA philosopher separates Natural or God made laws in Natural Science and man made laws like marriage , justice, income tax , in Social Science.
- Scientific Temper which applies rationality and logic to life , then becomes a social science.
- It has huge error bars (Large h), no agreed axioms and requires immense tolerance for alternative views.

References

1. Asoke Nath Mitra, (Profiles of Scientific Philosophy; Paradigms and Serendipity Current Science 64,162 (1993)
2. “Duality in Physical Sciences and Beyond”, Pramana-J- Phys.27,73 (1986)
3. “Parameters of Physics Perspectives: Principles, Postulates and Prejudices”, Physics News 21,7 (1990)
4. India in the world of Physics: Then and Now , Pearson Education,2009, History of Science, Philosophy and Culture in Indian Civilisation Vol XIII Pt 1.

This is a remarkable book, edited by ANM, with very valuable reviews by experts. It also has a remarkable photo in the beginning by Jean Jacques and Gargi Delemont of the areas of Physics covered after independence in India. Seemar majhe asim tumi bajao apan sur. (Amidst the finite, the infinite You play your own tune.)” -Tagore

5. Forward to “The Philosophy of Vedanta: A Modern Scientific Perspective” by R.S.Kaushal, pub. DKPrinters, Delhi (1993); Thanks are due to Dr R.S.Kaushal for a copy of the Forward.

Black Holes (BH)

- BH came in to Astrophysics in 1931 when S. Chandrasekhar showed that white dwarfs have an upper limit in mass. Shown, True for neutron stars also. More massive stars, after fuel is finished, if they can not shed mass, must become BH.
- Long period later Wheeler and his group and Soviet groups continued working on BH. In 1972 Misner, Thorne and Wheeler summarised the status in the book “Gravitation”. Quasars were identified with BH.
- CVVishweswara proved the stability of BH in 1970. He also calculated the quasi (damped) normal modes (QNM) of BH. These were the typical signals observed in gravitational waves when they were observed in 2016. Vishu died, a year later, too soon to enjoy his glory.
- Chandra came back to BH in the 1960s. As usual he wrote a classic book on “Mathematical Theory Of Black holes”, in 1983.

BH Now with JW telescope and Early Universe

- Two of the leading members in US in BH now are of Indian origin.
- Ramesh Narayan at Harvard and Priyamvada Natarajan at Yale.
- Priyamvada predicted BH in early universe. This was confirmed by James Webb telescope. Ramesh, son of GNRamachandran ,has extensively worked on accretion by BH, is now working with her and others on emission from galactic nuclei in early universe.
- Priyamvada's early mentor in Delhi was Nirupama Raghavan, who was the Director of Nehru planetarium and only person who worked with the telescope in the physics deptt, Delhi university. Later Priyamvada worked with Martin Rees in UK.

BH QNM and Delhi Univ. Physics Deptt.

- Stability (in BH and elsewhere) is studied by perturbing the BH metric and seeing if the added signal is damped and dies out, emitting QNM. Solving the perturbed equations by separating the variables is an arduous mathematical job.
- In 1971, Prof SNBiswas in DU with 4 other talented youngsters, Kamal Datta, RPSaxena, PKSrivatsava and Vijaya Varma discovered a simpler way of solving the problem of anharmonic oscillator with the help of Hill determinants. (Phys.Rev. D4,3617 (1971))
- In 1989 Bhabani Majumdar and I, (Phys.Rev. D40, 2568 (1989)) applied this method to BHQNM. It is said that people will queue up in front of your house, if you build a better mousetrap. There are 50 citations of that paper. Not a large number but very surprising to us. The cited papers used our method successfully.

DU Hill Determinant method

- A General differential when expressed as an infinite sum of constant coefficients gives a recurrence relation between them.
- The boundary condition to be satisfied by QNMs at event horizon of BH and at $r \rightarrow \infty$ determines a three term recurrence relation.
- Hill determinant can be written down once the recurrence relation between the constants are known. The vanishing of the Hill determinant helps in finding the eigenvalues of the solution.
- We can call this the DU Hill determinant method. Till an improvement is found this can serve as The method for the moment.
- This was Bhabani's PhD thesis . Unfortunately she did not continue in academic line.

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The End

- Have sent a copy of my Current Science article on Scientific temper and Education separately. Curr. Sc. 133,1655 (10 Nov 2017). May help in clarifying ideas.
- Thanks to All of you
- Thanks Gargi , Alok and his team and the others participating in these lectures, to make it such a success.
- Hope the whole programme goes well.

Mitra's final conclusion and Mine

- Quote by Alfred North Whitehead
- Religion is the vision of something which stands beyond, behind and within the passing flux of immediate things, something which is real, and yet waiting to be realized; something which is a remote possibility, and yet the greatest of present facts; something that gives meaning to all that passes, and yet eludes apprehension, something whose possession is the final good and yet beyond all reach, something which is the ultimate ideal and the hopeless quest.
- Nice way of saying : “We do not know.”
- My ideas “Scientific Temper and Education ; A framework for Discussion”, Curr. Science , 113,1655(2017). Close to that of Einstein.

Religion is also, Basis for Values and Ethics

- Upanishad, Advaita, Nirvana, Kingdom of Heaven, Tao, Yahweh
- Meditation, Yoga, Vipassana in India, Other ways in other religions
- Do they lead to truth ? Asks ANMitra
- Will Science also lead to Truth ?
- Einstein described ecstatic revelations like “A Cosmic Religious Feeling”. He believed that ,Values are given by People with revelations. Hindus call it Brahmananda

Feynmann told Fred Hoyle that a few minutes of Ecstasy is not enough. Hindus believe it may take several births to get Ecstasy or Moksha.

Wigner and Consciousness for Wave function Collapse

- Made in 1960s, but withdrawn in 1990s, when decoherence came in.
- Decoherent coarse grained Alternative Histories are the starting points now. One avoids having Classical Physics like in Copenhagen interpretation. ANMitra has described them in 2009 in his book.
- No Common agreement .
- Motivation for Religion is also the need for Values and Ethics.
- As also to accommodate the discussion of emotions: Joy, Compassion, Love, Ecstasy. These occupy much more of our lived than Rationality.
- One can separate natural and social science by Nature or God made laws, human or Social laws like for marriage, property, judiciary etc.

Values Ethics and Emotions

- In 1970s Fritzof Capra argued that quantum physics resembles the world view of Eastern mysticism. Bootstrap will be the next theory. But Quarks brought back the idea of fundamental particle. Bootstrap is nowhere.
- What we need seems to be more of Love, Compassion, Joy , Ecstasy and so forth. If we are going to avoid religion, because of secularism, and use our Constitution, then we have to have all these emotions in the constitution also. Not just fraternity.

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