Contributions and contradictions of Einstein – synthesis of knowledge of the West with wisdom of the East

Sudhish Chandra Banerjee

Some of the important contributions of Einstein and their impact on advancements of science for the next hundred years since 1905, have been briefly outlined. The paradox in the scientist of the century versus his academic excellence has also been touched upon vis-à-vis contradictions in his personal bias and life. Comments have also been made as regards knowledge of West with the wisdom of the East – converging in Einstein, the visionary.

Keywords: Einstein, energy, mass, philosophy, relativity theory, space–time, Vedanta.

IN Hindu mythology is depicted a character 'Jada Bharat' – the story of an apparent mute and dumb boy, similar to having Down's syndrome in our present terminology. The first sentence that he could utter only after attaining his youth was a great sermon of abstruse philosophical wisdom, the essence of Vedanta. At once, the king who hired him as his carriage bearer and was shouting at him, lay prostrate at his feet and became his disciple. Jada Bharat had then come out from his self-imposed shell of silence to become a great wise sage.

Likewise, we find it rather a mystery that Einstein, who could not talk till he was four and was not able to construct a full sentence till his 9th birthday[1], a systematic non-performer in academics[2], suddenly shone like a sunburst over the scientific and academic community in 1905 (from his hibernation in a patent office desk in his twenty-sixth year). His visionary approach propounded in the 21-page thesis[2], virtually made a paradigm shift of the Newtonian mechanistic model of the universe to the relativistic conceptualization of the cosmos. In fact, Einstein's 12 years contribution to physics, between 1905 and 1916, subsequently opened up new frontiers of our knowledge of the universe, like black holes, gravitational waves, the accelerating universe and the recently advocated string theory (the theory of everything). It would not be an exaggeration to say that today's physicists live in the universe that Einstein first visualized in 1905; so much so that the General Assembly of the United Nations has proclaimed 2005 to be the International Year of Physics[3]. Physicists, however, call it simply the Einstein year.

Sudhish Chandra Banerjee lives at 2 Diamond Park, Flat 10, Kohinoor Apartments, PO-Joka, Kolkata 700 104, India.
e-mail: drscb@rediffmail.com

The terms energy, time, space and gravity got new connotations from Einstein's play with mathematics and light, which took a long time for even the men of science to comprehend. Subsequent careful studies not only established Einstein's abstract ideas in more firm a footing, rather it opened up new vistas of our knowledge, like quantum mechanics, especially to explain the micro-world. But the biggest paradox is that Einstein, who virtually godfathered quantum theory, could not come out of his shell of personal bias and subjective beliefs, disowning some of its important advancements, which were rather based on his own theories, put forward in 1905, viz. the special theory of relativity and advanced later in 1916 for wider application, with the general theory of relativity.

Relativity theories – the beginning of a new era in science

Einstein argued that different observers moving at different speeds would have different perceptions of time and space – but the speed of light and laws of physics remain the same – under all circumstances. Because of this, simultaneous events can appear to happen at different times and vice versa. In other words, our reality is not an absolute one, but is determined by our respective points of view (reference frame).

This approach presented in 1905, known as the special theory of relativity, applies only to objects/systems in uniform motion. It was further advanced to include accelerated systems as well, and propounded in 1916 with a new approach to the gravity concept, which was termed the general theory of relativity.

Some of the remarkable predictions that Einstein could make from the complex equations of these theories, setting up a new era in science are:

- Formulation of the equation on the equivalence of mass and energy, $E = mc^2$; where E is the energy, m the rest mass of a material object, and c the speed of light.
- Prediction of the bizarre phenomenon of time dilation and length contraction of moving objects – becoming perceptible on reaching near the speed of light.
- Introduction of the concept of gravitational force to be a wave, moving in all directions with the speed of light using 16 field equations[4].

Their physical significance, importance and Einstein's own dilemma in them are worth mentioning.

Equivalence of mass and energy

This single equation sums up the entire story of all actions and creations of the universe. It means mass is nothing but a form of frozen energy. Light has weight; the entire sunlight the earth receives from the sun/day would weigh just 160 tons[3]. Conversely, if the total energy content that remains dormant, in merely one gram of matter could be released, it would have been enough to run the biggest liner in the Atlantic[5].

This oft-quoted equation of Einstein opens up the possibility of tapping huge energy from little gross matter, and may be called the mother of nuclear bomb and nuclear power – influencing the world political scenario, since the Second World War. But the biggest paradox is that Einstein himself was not only unaware of, but was totally dismissive of, such a possibility of its military use, even when pointed out to him by an enthusiastic youth[2] as early as in 1921. What Leo Szilard could foresee in 1933 on the utilization of Einstein's equation for military use, seemed to be a cock-and-bull story of any practical utility by its inventor[2], as late as in 1939. The letter that Einstein wrote to President Roosevelt in August 1939 was drafted by Szilard who persuaded Einstein to sign it, on behalf of the scientific community to convince USA for the Manhattan project (creation of atom bomb) – to resist Hitler.

Time dilation and length contraction

Einstein overthrew the commonsense concepts of space and time. He said that relative to the observer, both are altered on approaching the speed of light; length shrinks in the direction of motion and time slows down. In fact, this apparently bizarre phenomenon follows as a direct corollary to maintain the postulate that the speed of light in vacuum is the same for all inertial observers.

Space and time are hence rescaled, to annul the velocity addition rule – that may affect the speed of light, which must never change (by the term light, the relativists mean electromagnetic waves of widely varying frequency, not just the visible range of light only).

Its physical significance can be understood by the thought experiment suggested by Einstein, commonly termed the twin-paradox – involving two twins of exactly the same age. One of them sets out on a journey into space and back. Because of the time dilation effect of relativity, the twin who set out experiences a slowing down of time and will actually be much younger than the twin that stayed behind.

Likewise, because of length contraction a hypothetical space ship, say 200 ft long, moving horizontally with 99% the speed of light, would have a length contraction in the horizontal dimension and become 28 ft long, but with no change in vertical direction (height).

Detection of extremely unstable cosmic particles, like muons at sea level is direct evidence of Einstein's wisdom in this novel concept of time stretching and space squeezing[4]. It also opened up new horizons in physics, unifying space and time into the concept of four-dimensional SPACETIME, to describe the position of an object, replacing our classical notion of limiting ourselves to only three space coordinates.

The suggestion that space and time may not be absolute entities as Newton conceived them, makes Einstein rather closer to the philosopher Immanuel Kant than to the scientist Newton[4].

Gravitational wave

Einstein elucidated in 1916, with 16 field equations of tensor calculus and metric[4] that gravitational force is a sort of wave travelling in all directions with the speed of light (something like an advancing wavefront in a stretched rubber sheet when shaken). The full implication of all these equations, visualizing Einstein's concept, is yet to be completely understood. Arthur Eddington's experiment of measuring the bending of starlight (red-shift), during total eclipse of the sun in 1919, conclusively proved Einstein's acrobatics with mathematics to reveal nature[3]. The deflection of light by gravity was observed to occur exactly as predicted by Einstein.

His equations also implied that the more is the matter in a region, more would be the curvature of SPACETIME, dragging more matter towards it. For too strong a space-time curvature, with very high drag, even light cannot escape to come out and shine; foretelling the scope of the presence of black holes in the cosmos, detected only recently[4]. In fact, evidence of the presence of dark energy pervading 73% of the cosmos, success of the big bang theory on creation of the universe and its accelerated expansion, all are the legacies of Einstein's concept of gravity and energy[6].

When physicists speak about expansion of the universe, the natural question asked by a non-science person is, 'expanding into what?' The answer is given by Einstein's four-dimensional space-time concept, viz. expansion of the universe means, its property of space-time is increasing,

rather the space-time distance between two points in cosmos is increasing[4]. In fact, present-day physicists and cosmologists are yet to come out from the world conceived by Einstein. Recent concepts being advanced on super string theory, terming it to be the theory of everything, are virtually an extension of Einstein's four-dimensional space-time concept, adding five more dimensions to explain nature.

Wisdom of Einstein – mystery or the mystic

It is strange that Einstein, regarded as a phenomenon in physics, had perhaps envisioned nature unfolding its secrets to him – rather than arriving at his conclusions from systematic logical academic pursuits, nor even from mathematical skills. It was Minkowski, who appreciating Einstein's ingenious relativity ideas, gave it the language of mathematics, for the scientific community to comprehend and appreciate[2]. Einstein had to learn later the geometry of curved surfaces (Reimann geometry) and tensor calculus from his class friend Grossmann[2], so that the SPACETIME concept that he built in his head, could be communicated to the scientific community in the language they may be able to understand – the language of mathematics.

A comparison of such contradiction on Einstein's originality versus his academic excellence may be drawn from a historical character, Joan of Arc from France, as depicted in George Bernard Shaw's drama *St. Joan*. The innocent peasant girl, Joan of Domremy in France had a vision that a VOICE wanted her to lead the French army, which was being defeated by the British in its own soil; and Joan did lead the army to achieve success. It was too much for the French captain working under Joan in the battlefield, to swallow the dictum of Joan's VOICE and asked her to explain the logic in each of her commands that she suggested to be coming from her VOICE. After her successes, when the captain was praising Joan's explanations of military strategies, Joan exclaimed, 'But my VOICES come first, because you won't believe in my VOICES, so I "create" my arguments afterwards'.

Likewise, perhaps Einstein may also be considered to have his vision of the rule of Cosmos first, and in order to communicate with the scientific world, he created its explanation with the language of mathematics afterwards. Should we then consider Einstein to be more of a mystic, whom God chose to reveal some of the secrets of His creation? Einstein himself, however, refuted such accolades of giving a religious twist to his ideas. He used to say that his ideas were simply the legacy earned from his predecessor scientists like Galileo, Newton, Lorentz, etc.

It is of course a fact that Einstein could make good use of neglected discoveries by other scientists and had the far-sightedness to realize the possibilities of new approaches, which many of his contemporary scientists missed. Two glaring examples may be cited:

- Satyendra Nath Bose, then a young Indian scientist from Calcutta, India, sent a paper in 1924 to Einstein for comments (on a novel statistical approach to derive Plank's equation), which had been rejected for publication by referees of a scientific journal. Einstein could at once see to its immense possibilities, which later on came to be famous as Bose–Einstein statistics[2]. A renewed interest on it has grown recently in 1995, to create super-atom for use in extremely sensitive measurements based on Bose–Einstein condensate[3].
- Another famous young scientist, de Broglie during the same period shrewdly sent his thesis to Einstein for comments – suggesting the hypothesis that electrons can have wave properties as well – which was too revolutionary an idea at that time for his examiners to accept[5]. Einstein's enthusiastic comment, 'He has lifted the corner of the great veil' (of nature), not only earned de Broglie a Ph D, but also a Noble Prize later.

However, it remains a mystery that Einstein, an ardent seeker of truth, could limit his wisdom sticking to a blind faith in an ordered scheme of perfect universe, rejecting the scientific advancements of quantum theory that allowed 'uncertainty' to intervene in the universe (probabilistic concepts). Einstein dogmatically said, 'God (meaning nature) does not play dice'. Niels Bohr (Copenhagen School of Physics) retorted back, 'Stop telling God what to do!'[3]; and showed from Einstein's own equations the uncertainty factor ingrained in quantum mechanical concept to explain the micro-world[2]. Einstein spent his last 30 years unsuccessfully trying to unify gravity and electricity; whence electricity could be attacked properly only in terms of quantum theory. Perhaps, Einstein confused 'uncertainty' of sub-atomic particles in its statistical sense, with the uncertainty of cause and effect – which he abhorred, being influenced by Spinoza's deterministic philosophy.

Einstein's contradictions

His life

Many a time destiny played cruel jokes with Einstein, with many a contradictions in his life. It is not only that Einstein disowned advancements of his own brainchild, the quantum theory, for academic pursuits in his later years. In his personal life also, he had to stay away from his own children (who were brought up by his divorced wife Mileva Miric, with his Nobel Prize proceeds) and be contented to live with his foster daughters of his second wife, Elsa.

Barely at sixteen, Einstein renounced both his German citizenship and Jewish faith[2] only to become one of the frontline advocators of the Zionist movement in later years (for various reasons). He was even offered the post

of the first President of Israel, which Einstein politely refused though.

Later, he revived his German citizenship to avail the opportunity for undertaking academic pursuits, but had to renounce it again in 1933 due to anti-Semites movement in Hitler's Germany; Einstein settled in America, being exiled from Europe[2].

Einstein had been a pacifist in his political opinion and had always been against any war – being a strong humanist in his philosophy of life. But destiny made Einstein to play a pivotal role in decision-making on the creation of nuclear arsenal – only to become later a strong anti-nuclear campaigner (along with other scientists like Linus Pauling, Leo Szilard, Hans Bethe, Bertrand Russel, etc.) – from the lessons learnt of the Hiroshima/Nagasaki catastrophe[2].

It is quite revealing to learn that Einstein, a high profile, famous personality in Princeton, USA, was not fully trusted by the US secret agencies. A secret dossier over him was kept by FBI, which considered Einstein, the humanist to be a communist sympathizer – who had been totally sidelined to play any active role in nuclear projects[2].

Einstein's philosophy of life

Einstein's philosophy of life had also some innate contradictions. He had a firm faith on Spinoza's God format, with the universe being governed by a mechanical and mathematical order (with no uncertainty or 'chance' factor to play any part) – such that all events in nature occur according to immutable laws of cause and effect alone. He denied any role of God over individuals, on the effect of their actions like prayer, etc.[7]. This may sound nice, refusing to accept a personal God sitting in the judgment throne, up above. It however, falls flat with the Vedantic concept of God; where individuals are considered to be only an apparent identity of the inseparable continuum of universal consciousness.

In this school of thought, the God-concept *vis-à-vis* fruits of action does not stem from the punishing and rewarding God – but as *sa isa premaswarupa* – love becomes the other name of God. Broadening of the self and identifying itself with the perceptions of oneness with the infinity, becomes intermingled with the God concept, which is only to be realized and conceived within; not a topic for understanding or explaining but for realization only.

In fact, Einstein's dilemma as a scientist also arose because of the contradictions that he tried to grasp the infinity with the fixed notion of a finite approach.

His informal discussions, with the poet-sage Rabindranath Tagore of India in 1930, speaks volumes on wisdom of the East *vis-à-vis* the knowledge of the West[8]:

TAGORE: I was discussing with Dr Mendel today the new mathematical discoveries, which tell us that in the realm of infinitesimal atoms, chance has its play; the drama of existence is not absolutely predestined in character.

EINSTEIN: The facts that make science tend toward this view do not say good-bye to causality.

TAGORE: May be not, yet it appears that the idea of causality is not in the elements, but that some other force builds up with them an organized universe.

EINSTEIN: One tries to understand in the higher plane, how the order is. The order is there, where the big elements combine and guide existence, but in the minute elements, this order is not perceptible.

TAGORE: Thus duality is in the depths of existence, the contradiction of free impulse and the 'Directive Will' which works upon it and evolves an orderly scheme of things.

Einstein's speech given two years later, to the German League of Human Rights at Berlin, is quite revealing about his concept of this 'Directive Will', that Tagore hinted at. Einstein said quoting philosopher Schopenhauer, 'I do not believe in the freedom of will. Man can do what he wants, but he cannot will what he wills'.

This approach however, seems to be self-contradictory for all practical purposes. To an usual thinking – willing – doing person, are not all the actions prompted and followed from the programmes set by our will? If we have no choice to 'will' ourselves, then we automatically lose our freedom over our actions as well, that only follows the 'will'. It is the God-intoxicated realized souls, who perhaps can only feel in their every breath that, willing and the actions and everything stems from the Universal Consciousness alone, and there is nothing else than that. For others, it just ends up in contradictions or vain talks.

Comments

Einstein however, revealed himself towards the end of the same lecture, in whom we find the shadow of the ancient Indian seer. He said, 'the most beautiful and deepest experience a man can have is the sense of the mysterious. It is the underlying principle of religion as well as serious endeavour in art and science. He who never had this experience seems to me, if not dead but blind'.

It was through Einstein's footsteps that science could now identify the universe with the energy (SAKTI) – encompassing time, space, and all we can think of. Science now thinks in terms of the energy, only of energy and nothing but energy. Right from the primordial timeless, space-less point of singularity, where energy is identified with the infinity – to the present stage of expanding universe with accelerated expansion of space-time having

an apparent symmetry; it all is the game of energy (SAKTI) alone.

Can science ever evolve a Neo-Einstein in future, to tell the scientific community and the world, that it is the still subtler identity, the Infinite Consciousness, which pervades everything and is the story of everything? Or, are science and scientists just a passing phase in the evolution of mankind to realize PERFECTION?

1. Baker, C., *The Smart Reader: Albert Einstein*, Recorded Books Inc, UK, 1997, p. 6.
2. White, M. and Gribbin, J., *Einstein – A Life in Science*, Simon Schuster, London, 1993.
3. Calder, N., *Einstein's Universe*, Penguin Books, London, 2005.
4. Bassett, B. and Edney, R., *Introducing Relativity* (ed. Appignanesi, R), Icon Books, Cambridge, UK, 2002.
5. Laidler, K. J., *Energy and the Unexpected*, Oxford University Press, 2002.
6. www.universeforum.org.einstein
7. Hawthorne, M., *Einstein's Religious Theses*, Hinduism Today (Philosophy), Jan/Feb/March 2004.
8. Rabindranath Tagore: In conversation with Albert Einstein, excerpt edited from Tagore Reader by Amiya Chakravorty, *The Religion of Man*, George, Allen & Unwin Ltd, London, Appendix 2, pp. 222–225.

Received 6 November 2005; accepted 19 November 2005

MEETINGS/SYMPOSIA/SEMINARS

Hands-on-Training Course on Microsatellite DNA Markers: Development and Analysis

Date: 2–10 February 2006
Place: Lucknow

The training will cover theoretical and practical aspects of a range of microsatellite markers, its development, genotyping and data analysis for genetic variability studies. The training is open to researchers working in the area.

Contact: Dr. Vindhya Mohindra
National Bureau of Fish Genetic Resources
Lucknow 226 002
Phone: (0522) 2441735
E-mail: nbfgr@sancharnet.in

Training Course on Genotoxic Biomerkers in Fishes

Date: 21–28 February 2006
Place: Lucknow

The course is intended to given to train the participants for *in vivo* assessment of genotoxicity of various chemical agents/ environmental pollutants at cell, chromosomal and DNA levels by Comet Assay (SCGE), Sister Chromatid Exchanges Assay (SCR), Micronuclei Test (MNT) and assays for detection of apoptosis.

Contact: Dr W. S. Lakra
National Bureau of Fish Genetic Resources
Lucknow 226 002
Phone: (0522) 2441735
E-mail: nbfgr@sancharnet.in

National Seminar on Current Biotechnology Research

Date: 19–21 January 2006
Place: Sivakasi

Themes include: Plant biotechnology, Animal biotechnology, Industrial biotechnology, Pharmaceutical biotechnology, Microbiology and microbial biotechnology, Agricultural biotechnology, Marine biotechnology, Environmental biotechnology, Bioinformatics, Biodiversity conservation, Proteomics and genomics, Intellectual property rights, Bio-energy.

Contact: Dr S. Baskaran
Organizing Secretary
Department of Biotechnology
Ayya Nadar Janaki Ammal College (Autonomous)
Sivakai 626 124
Ph: 04562 254100 (O)
Fax: 04562 254970