

Tesla, wireless energy transmission and Vivekananda

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Nikola Tesla, who was both an inventor and mathematician, persisted with actual experiments and speculations on wireless transmission of energy that went beyond the physics of the day. This note presents a summary of Tesla's ideas on wireless transmission to explain his intuition that he could use the capacity of ether to hold and transfer energy. This intuition was related to ākāśa, the Indian concept of ether, on which he communicated with Vivekananda.

Introduction

Nikola Tesla was an inventor and futurist whose contributions to the electrical revolution transformed daily life at the turn of the 20th century. He was a pioneer of AC electricity, induction motor, and X-rays, and contributed to the development of radio and television. He invented the Tesla coil to generate high-voltage, low-current, high-frequency alternating current (AC) electricity and he thought it could be used for wireless power transmission. As a futurist, Tesla speculated on various technological possibilities for mankind, visualizing robots that he called teleautomatons, flying machines that used ambient energy and systems that exploited solar energy^{1,2}.

Tesla spoke of converting matter into energy and he presumed that this could, in turn, be used for wireless applications. Evidence for this comes from the pen of Swami Vivekananda whom he met in 1896 at a party organized by the actress Sarah Bernhardt. The philosopher and celebrity Vivekananda had knowledge of Indian physics. It is generally accepted that he changed the world by bringing the movement for self-knowledge to America, and influenced some of the greatest minds of the 20th century³.

This is what Vivekananda had to say of that meeting in a letter dated 13 February 1896: 'Mr. Tesla was charmed to hear about the Vedantic *prana* and *akashā* and the *kalpas*. He thinks he can demonstrate mathematically that force and matter are reducible to potential energy. I am to go to see him next week to get this mathematical demonstration. In that case Vedantic cosmology will be placed on the surest of foundations. I clearly see their perfect union with modern science and the elucidation of one will be followed by that of the other⁴.'

As we know, Tesla did not succeed in showing this equivalence of mass and

energy, and the equation $E = mc^2$ was published just a few years afterwards. However, even after the publication of this equation, Tesla wrote on future possibilities related to wireless energy transmission that went beyond standard physics.

In this note, I present Tesla's general ideas in the context of *ākāśa* of Indian physics, which is supposed to be interconvertible with matter and other forms of energy. I argue that this property of *ākāśa*, which has not been discussed in relation to Tesla, was the reason why he was so persistent in developing new schemes for remote transmission of energy.

Tesla's life

A hundred years ago Tesla was a superstar. He competed with Thomas Edison, inventor and businessman, over what should be the industry standard for power transmission. Tesla was in favour of AC and Edison for direct current (DC), and Tesla won; so in the sense of delivery of electric power, we live in the Age of Tesla.

Tesla was born on 10 July 1856, in what is now Smiljan, Croatia. His father was a Serbian orthodox priest. He studied engineering in Graz, Austria, but never graduated. Next he worked at the Central Telephone Exchange in Budapest, where the idea for the induction motor came to him. After failing to get people interested in this invention, Tesla, in 1884, decided to leave Europe for America.

Tesla first worked for Thomas Edison, but they parted ways very soon. In 1885, he got backing for the Tesla Electric Light Company to improve arc lighting. This venture failed and for some time he worked as a labourer. In 1887, he found backing for his AC electric system and

this became Tesla Electric Company. He filed for many patents and soon attracted the attention of George Westinghouse, who bought his patents for US\$ 60,000 in cash and stock in the Westinghouse Corporation.

Tesla, through Westinghouse, developed a range of electrical devices. His inventions include AC induction motor, power sources and a generator of high-frequency currents. The Westinghouse Corporation was chosen to supply the lighting at the 1893 World's Exposition in Chicago, which provided publicity to his AC system. Two years later, Tesla designed an AC hydroelectric power plant at Niagara Falls that was used to supply power to the city of Buffalo. These successes soon made the AC system the pre-eminent power system of the world.

In 1900, Tesla began working on a global wireless communication system – to be transmitted through a large electrical tower – for sharing information and providing free electricity throughout the world. He received funding for the project and in 1901, built a laboratory with a power plant and a huge transmission tower on Long Island, New York, that was known as Wardencliff. His idea was to use the earth as a means of return of current. He envisioned 'a machine which, to explain its operation in plain language, resembled a pump in its action, drawing electricity from the earth and driving it back into the same at an enormous rate, thus creating ripples or disturbances which, spreading through the earth as through a wire, could be detected at great distances by carefully attuned receiving circuits. In this manner I was able to transmit to a distance, not only feeble effects for the purposes of signaling, but considerable amounts of energy, and later discoveries I made convinced me that I shall ultimately succeed in conveying power without wires, for

industrial purposes, with high economy, and to any distance, however great⁵.

As doubts about the plausibility of Tesla's system arose and his rival, Guglielmo Marconi, won the financial support of Andrew Carnegie and Thomas Edison, Tesla was forced to abandon the project. The Wardencliff staff was laid off in 1906 and by 1915, the site had fallen into foreclosure. Two years later Tesla declared bankruptcy.

After his death in 1943, Tesla fell into relative obscurity. However, in 1960, the General Conference on Weights and Measures named the SI unit of magnetic flux density the 'tesla' in his honour. Thus science has immortalized his name.

Tesla's general ideas on wireless transfer of energy

Tesla concluded that the atmosphere itself could conduct electricity and this could be used to send energy without the need for wires. He had two broad ideas:

1. Electricity can be conducted through the atmosphere and he hoped that methods could be devised to control its distribution from one place to another. He believed that very high voltages in the range 15–20 million volts could be used for this purpose, at a height of 30,000–35,000 feet above sea level. He argued that such a system will be more efficient than an omnidirectional broadcasting antenna as is the case of radio transmissions, and thus allow the construction of a 'World Wireless Telephony and Telegraphy System'. He believed this would make transmission of simultaneous and non-interfering messages practical in a manner which is reminiscent of modern computer networks⁶.

2. Energy could be transmitted through the earth by exploiting its resonances. 'The chief discovery, which satisfied me thoroughly as to the practicability of my plan, was made in 1899 at Colorado Springs, where I carried on tests with a generator of fifteen hundred kilowatt capacity and ascertained that under certain conditions the current was capable of passing across the entire globe and returning from the antipodes to its origin with undiminished strength. It was a result so unbelievable that the revelation at first almost stunned me. I saw in a flash that by properly organized apparatus at

sending and receiving stations, power virtually in unlimited amounts could be conveyed through the earth at any distance, limited only by the physical dimensions of the globe, with an efficiency as high as ninety-nine and one-half per cent⁶.'

Tesla also believed that energy could be extracted from the sun's rays and, in this sense, he was a pioneer of solar energy as well⁷. He thought that directed electromagnetic energy in the atmosphere could be used for the propulsion of flying machines without the need for ground connection.

Ākāśa and Indian physics

Indian physical ideas, of which the concept of the *ākāśa* is a part, are described in the Vaiśeṣika system⁸. It has categories not only for space–time–matter, but also for attributes related to perception of matter. It starts with six categories (*padārthas*) that are nameable and knowable. Nothing beyond these six fundamentals is necessary, because they are sufficient to describe everything in the universe, from concrete matter to the abstract atom.

The six categories are: substance, quality, motion, universal, particularity and inherence. The first three have objective existence and the last three are a product of intellectual discrimination. Universals are recurrent generic properties in substances, qualities and motions. Particularities reside exclusively in the eternal, non-composite substances, that is, in the individual atoms, souls and minds, and in the unitary substances ether, space and time. Inherence is the relationship between entities that exist at the same time. It is the binding amongst categories that makes it possible to synthesize experience.

Of the six categories, the basic one is that of substance and the other five are qualities associated with the substance. Observers belong to the system in an integral fashion, for, if there were no sentient beings in the universe, there would be no need for these categories.

There are nine classes of substances, some of which are non-atomic, some atomic, and others all-pervasive. The non-atomic ground is provided by the three substances of *ākāśa*, space, and time, which are unitary and indestructi-

ble; *pr̥thivī*, *āpas*, *tejas* and *vāyu* are atomic composed of indivisible and indestructible atoms. The basic atoms of *pr̥thivī*, *āpas*, *tejas* and *vāyu* will be represented by *P*, *Ap*, *T* and *V* respectively.

The sequence of evolution of the elements, which occurs in extraordinary circumstances, is given as $V \rightarrow T \rightarrow Ap \rightarrow P$.

The ordinary molecules of matter have all the basic atoms present in them. The interactions of the atoms are governed by four different forces: *P* interacts with all the four, *Ap* with three, *T* with two and *V* with one.

The commentators of the Vaiśeṣika claim that only *P* and *Ap* have mass; *T* and *V* do not⁹. The four atoms are a function of four different subtle elements called Ru (*rūpa*), Ra (*rasa*), Ga (*gandha*) and Sp (*sparśa*). Symbolically, we may summarize this in terms of the following expressions

$$P: \phi_1 (\text{Ru, Ra, Ga, Sp}),$$

$$Ap: \phi_2 (\text{Ru, Ra, Sp}),$$

$$T: \phi_3 (\text{Ru, Sp}),$$

$$V: \phi_4 (\text{Sp}).$$

Molecules that are comprised of many atoms may be represented by

$$\text{Molecule: } \varphi (P_m, Ap_n, T, V),$$

with mass equal to $m\text{Mass}(P) + n\text{Mass}(Ap)$, since *T* and *V* do not possess mass.

In this system, distinguishing characteristics and motion are essential for the classification of matter. Space and time are identified through motion of matter or in relation to the motion of the sun. Among the substances, four are material (that is consisting of atoms) and capable of motion, whereas others (time, space, *ākāśa*) are non-material and, therefore, no motion may be associated with them.

When the universe ceases to be at the end of the cosmic cycle (*kalpa* mentioned in Vivekananda's letter), matter is not annihilated; rather, it reaches a quiescent state where its atoms have no extrinsic motion and so become invisible, which appears similar to the conception of the state of the giant atom at the beginning of the cycle of creation. The lack of motion represents a cessation of

time, because time is a measure of change.

In an article, written in 1907 but published in 1930, Tesla wrote about the use of *ākāśa* and *prāṇa* to solve mankind's greatest problems¹⁰:

Long ago... [mankind] recognized that all perceptible matter comes from a primary substance, or tenuity beyond conception, filling all space, the *Akaśha* or luminiferous ether, which is acted upon by the life giving *Prana* or creative force, calling into existence, in never ending cycles all things and phenomena. The primary substance, thrown into infinitesimal whirls of prodigious velocity, becomes gross matter; the force subsiding, the motion ceases and matter disappears, reverting to the primary substance.

In the above quote, Tesla defines the *ākāśa* as ether, but then he associates properties to it that are not mentioned in the context of ether in the Western tradition and are true for *ākāśa*. We have mentioned earlier how, under certain conditions, the *ākāśa* can generate energy and give rise to atoms that constitute matter. In the reverse process, matter and energy can transform into *ākāśa*. It appears, therefore, that Tesla was not only hoping to convert one form of energy into another but also exploit the *ākāśa*, which he may have visualized as a field similar to the electromagnetic field, to transmit energy from one place to another; his goal was to harness the primal energy within space itself.

Conclusion

It appears that Tesla was hoping to tap into the fundamental interconvertibility of *ākāśa* with matter and other forms of energy to develop new ways of harnessing and transmitting energy. In spite

of some of his speculations not being practical, his intuition was to seek other novel ways for such interconversion.

Note further that Tesla's use of *prāṇa* is ultimately concerning the relationship of energy and information. Indian philosophy speaks of *ākāśa* serving as an intermediary between mind and matter, which to the subject is available as *prāṇa* (e.g. *Brahma Sūtra* 1.1.22-23, 2.4.9)¹¹. Note further that the six ontological categories of the Vaiśeṣika are neatly divided into three for matter and three for the mind of the observer. This was an issue that was not a part of physics of Tesla's times, but it has come into contemporary physics due to the problem of measurement of quantum mechanics to which the Copenhagen Interpretation provides one resolution (although it is not universally accepted). In von Neumann's orthodox version of this Interpretation, mind and matter are two distinct ontological categories¹², suggestive of the corresponding dichotomy in the Vaiśeṣika (though the two dichotomies should not be considered identical).

More recently, it has become accepted that the vacuum state is associated with a zero-point energy, and this zero-point energy has measurable effects. Indeed the vacuum is teeming with creation and destruction of particles, and some have visualized this as the akashic field. The idea of an akashic field that is the medium of consciousness has been proposed by the Hungarian scientist Ervin László¹², who posits a field of information as the substance of the cosmos¹³.

Although Vaiśeṣika postulates that the *ākāśa* is an element, it cannot be the medium that carries consciousness. Also, consciousness is not a new state of matter because if it were so, then the equations of physics are incomplete. Physics as we know it can only be about inert objects and not the experiencing self.

In conclusion, Tesla proposed several speculative systems of power and infor-

mation transfer, some of which anticipated modern technological inventions. In speaking of the *ākāśa* he was considering processes and phenomena whose validity is yet to be demonstrated by experiments.

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