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# THE INDIAN ASSOCIATION OF PHYSICS TEACHERS

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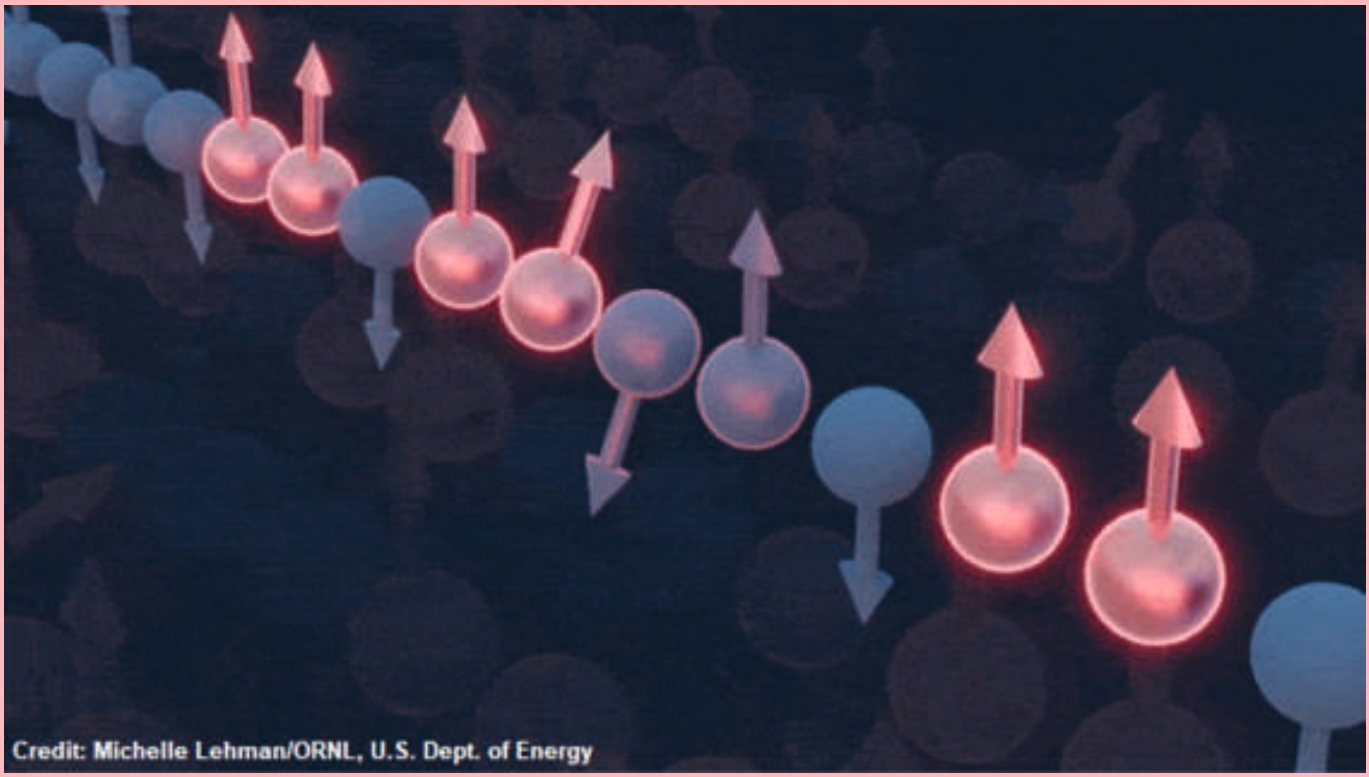



Spin chains in a quantum system undergo a collective twisting motion as the result of quasiparticles clustering together. Demonstrating this KPZ dynamics concept are pairs of neighbouring spins, shown in red, pointing upward in contrast to their peers, in blue, in alternate directions. Using complementary computing calculations and neutron scattering techniques, researchers have discovered the existence of an elusive type of spin dynamics in a quantum mechanical system. They successfully simulated and measured how magnetic particles called spins can exhibit a type of motion known as Kardar-Parisi-Zhang, or KPZ, in solid materials at various temperatures. Until now, scientists had not found evidence of this particular phenomenon outside of soft matter and other classical materials. These findings show that the KPZ scenario accurately describes the changes in time of spin chains - linear channels of spins that interact with one another but largely ignore the surrounding environment - in certain quantum materials, confirming a previously unproven hypothesis. Observing this unconventional behaviour provides insights into the nuances of fluid properties and other underlying features of quantum systems that could eventually be harnessed for various applications. A better understanding of this phenomenon could inform the improvement of heat transport capabilities using spin chains or facilitate future efforts in the field of spintronics, which saves energy and reduces noise that can disrupt quantum processes by manipulating a material's spin instead of its charge.
(https://scitechdaily.com/quantum-materials-unconventional-spin-behavior-proves-theoretical-predictions/)

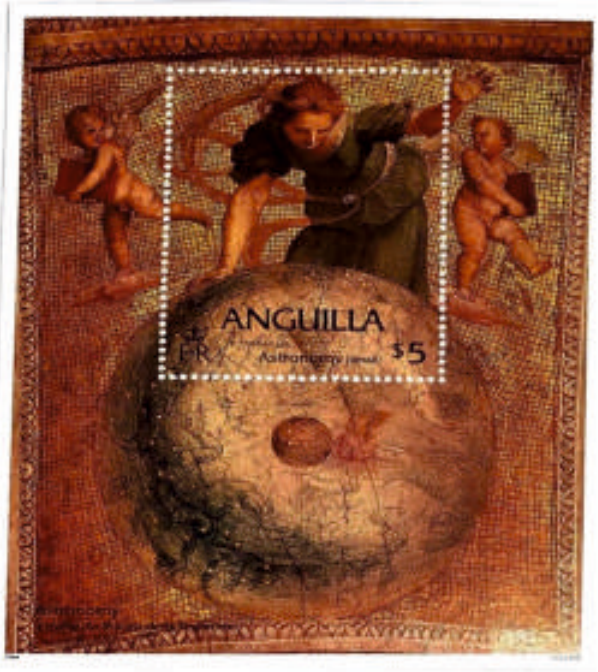
# The Story of Cosmology through Postal Stamps- 08

## THE ANCIENT ASTRONOMY

***GREEK AND ROMAN PERIOD (27 BC-1400AD)***

**Philosophies of Ionian school of thought, which developed in 6th century BC at Miletus at the coast of Asia Minor, made real contribution to the astronomic theories at that period. First cosmological model of the visible universe was also developed in this period**

**Mythological origin of Universe as envisaged by Greeks and depicted in paintings and murals**



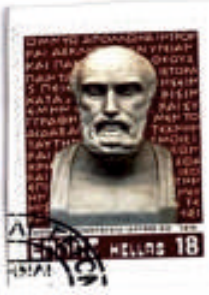

***Prime mover*-Painting by Raphael -Wisdom, the creator of universe bending over celestial globe with earth at the centre of the globe**


***Se-Tanent pair*-Birth of Planet ,Sun and Man -by Michelangelo**


**Greek mythology depicted in Constellations**


***Charity Stamp*-for Old and Children,** depicting Star Sirius as mention in epic Odyssey


***Democritus*- pre-Socratic philosopher proposed Atomic theory of the Universe**




***Hippocrates***


***Aristrachus*-3rdcentury BC – his calculation to measure the size of the earth**

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# Editorial

Friends,

I wish to talk to you about the Bulletin which I hope all of you are getting regularly. To bring out a monthly journal, a semi-technical one at that, in time every month is not an easy task. Last few days of every month are tense when we strive to put everything in order and send the manuscript to the Press at Kanpur where it must reach by the end of the month. The date of dispatch of the Bulletin, fixed by the Post Office, is 8$^{th}$ of every month.

Over the years we have tried to make the Bulletin rich in content and production quality. The senior members amongst you will testify to that. However, we, as the editorial team, feel disappointed and for a very good reason. Now and then we make changes – add a new feature, change in the getup, presentation of the matter etc. But there is no feedback from the readers – neither criticism nor appreciation or a new suggestion, no comment on printed matter either.

This Bulletin was started by Dr. D.P. Khandelwal as a vehicle of communication among the members of the Association. They can report what they are doing, they can comment on what others are doing, they can suggest what ought to be done and so on. It should reflect the buoyancy of the organization.

Please be observant, vigilant – there is so much to report/ talk /think about within the organization and outside it. Express yourself.

May I suggest a few things. If you happen to notice some error in a question in a public examination (university/board/selection test etc), do report it. If there is a newsworthy scientific/physics event in your neighborhood, report it. If there are any changes in the physics syllabi of your University/ Board which ought to be taken notice of, comment on it. And, so on.

The Letters to the Editor serve as incentive to editors of any journal to take it to new heights. When there is no feedback from the readers, editors are not sure if what they are doing is worth it or not.

**U S Kushwaha**

# PHYSICS NEWS

**Researchers achieve first quantum simulation of baryons**

A team of researchers performed the first-ever simulation of baryons - fundamental quantum particles - on a quantum computer. With their results, the team has taken a step towards more complex quantum simulations that will allow scientists to study neutron stars, learn more about the earliest moments of the universe, and realize the revolutionary potential of quantum computers.

Non-Abelian gauge theories are particularly interesting candidates for simulations because they are responsible for the stability of matter as we know it. Classical computers can simulate the non-Abelian matter described in these theories, but there are important situations - such as matter with high densities - that are inaccessible for regular computers. And while the ability to describe and simulate non-Abelian matter is fundamental for being able to describe our universe, none has ever been simulated on a quantum computer.

Researchers developed a resource-efficient quantum algorithm that allowed them to simulate a system within a simple non-Abelian gauge theory on IBM's cloud quantum computer paired with a classical computer. With this landmark step, the researchers are blazing a trail towards the quantum simulation of gauge theories far beyond the capabilities and resources of even the most powerful supercomputers in the world.

**Read more at :** https://phys.org/news/2021-11-quantum-simulation-baryons.html

**Original paper :** Nature Communications (2021). DOI: 10.1038/s41467-021-26825-4

**Skyrmions: Fundamental particles modelled in beam of light**

Scientists have succeeded in creating an experimental model of an elusive kind of fundamental particle called a skyrmion in a beam of light. The breakthrough provides physicists with a real system demonstrating the behaviour of skyrmions, first proposed 60 years ago.

The idea earlier used the structure of spheres in 4-dimensional space to guarantee the indivisible nature of a skyrmion particle in 3 dimensions. 3D particle-like skyrmions are theorized to tell us about the early origins of the Universe, or about the physics of exotic materials or cold atoms. However, despite being investigated for over 50 years, 3D skyrmions have been seen very rarely in experiments. This new study has demonstrated for the first time how skyrmions can be measured in three dimensions. The new model uses the standard description of light, the polarization and phase in terms of a sphere in 4-dimensional space, crucial to Skyrme's original vision.

**Read more at :** https://phys.org/news/2021-11-skyrmions-fundamental-particles.html

**Original paper :** Nature Communications (2021). DOI: 10.1038/s41467-021-26171-5

**Electrons set the stage for neutrino experiments**

Neutrinos may be the key to finally solving a mystery of the origins of our matter-dominated universe. Now, a team of nuclear physicists have turned to the humble electron to provide insight for how these experiments can better prepare to capture critical information. Their research reveals that major updates to neutrino models are needed for the experiments to achieve high-precision results.

One way to study neutrino oscillation is to build gigantic, ultra-sensitive detectors to measure neutrinos deep underground. The detectors typically contain dense materials with large nuclei, so neutrinos are more likely to interact with them. Such interactions trigger a cascade of other particles that are recorded by the detectors. Physicists can use that data to tease out information about the neutrinos.

**Read more at :** https://phys.org/news/2021-11-electrons-stage-neutrino.html

**Original paper :** Nature (2021). DOI: 10.1038/s41586-021-04046-5

**Pankaj Bhardwaj**
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ARTICLE

# One Hundred Years of Nobel Prize of Albert Einstein: Nominations and More

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**Abstract**

*Albert Einstein had won the 1921 Physics Nobel Prize that was announced in 1922. In the Nobel citation there was no explicit mention of his theories of relativity for which Einstein became a legend. He received nominations for Nobel Prize after his Special Theory of Relativity but a significant rise in the number of nominations could be observed only after his General Theory of Relativity. We discuss here the pattern of nominations Einstein received along with the perceived impact of the First World War in the process. We shall also try to find out why the Noble committee on Physics did not take the theories of relativity into consideration.*

## Introduction

Owing to the outbreak of the First World War in 1914 the announcement of Nobel Prizes turned irregular. There was no Physics Noble Prize in 1916, and the 1917 prize was first withheld and was then announced in 1918. Similar fate was met by some more Nobel Prizes from other areas during that period. The reason is understandable. The selection of the Nobel Prizes is based on nominations from a selected band of people. And that could not be a wartime exercise as one could see that a significant number of frontline scientists actually suspended their usual research work and got involved in developing something functional whatever that might be for the use in the War for their side. After the First World War was over things took time to get to normal. Yet 100 years ago the 1921 Physics Nobel was kept on hold. Nobel Committee in Physics failed to identify any suitable physicist from amongst the nominated ones who could meet the criteria set by Alfred Nobel. The year 1922 saw the announcement of Physics Nobel Prize for both the year 1921 and 1922 and the announcement came in November 1922. Albert Einstein turned out to be the winner of the 1921 Physics Nobel Prize while the 1922 Physics Nobel went to Neils Bohr. And none of them had to share the Prize with any other physicist.

### The Nobel citation for Einstein award

The citation of the Nobel Prize for Einstein mentioned that he is being awarded "for his services to Theoretical Physics, and especially for his discovery of the law of the photoelectric effect." There was no specific mention of the Special theory of Relativity (STR, 1905) or General theory of Relativity (GTR, 1915) arguably two most widely known and path-breaking contributions of Einstein. Of course, some could see that the mention of "Theoretical Physics" in the citation took care of both STR and GTR. The concept of STR and the ideas put forward there were fairly counter-intuitive and were indeed novel and out-of-the-box as it proposed the constancy of the speed of light in vacuum irrespective of the motion of the reference frame of the observer. It also introduced the idea of time dilation to explain the observations of Michelson-Morley experiment. That way GTR stood apart with its mathematical complexities and was very much counter-intuitive and the concepts provided there generated real turbulence to the edifice of physics. The fact that Einstein is a household name today and any person even those who have not studied science beyond the school curriculum know his name as a great scientist that is because of his theories of Relativity and not because of the theory of photoelectric effect. People also know the equation $E = mc^2$ that appeared in the fourth paper of 1905 now is the part of school science text-books. Now possibly a common man also appreciates the fact that energy can be transformed into mass and vice-versa. On the other hand the fact that even the light ray gets bent under the influence of very strong

gravitational field fascinates many. Now we know that there are more in the theories of relativity that not only the physicists understand and deal with but technology also make use of them stretching the limits of theoretical physics and impacting the lives of common men through the finer corrections that make today's GPS so reliable.

A few important questions came up. First the theory of photoelectric effect was actually given by Einstein in one of his four path-breaking papers published in the year 1905. All the four papers were published in the German scientific journal of Annalen der Physik and a fifth paper was communicated in 1905 and was published in 1906. The year 1905 has always been referred to his Annus Mirabilis i.e. a miracle year in the life of Einstein. By next few years Einstein established himself as a theoretical physicist per excellence. And if the Nobel Prize were based only on the theory of photoelectric effect; lot of science historians feel, it could have been awarded to Einstein much earlier. But others argue that the Einstein's standing as a great theoretical physicist was built on the STR and GTR; and the Nobel citation actually indicated them without being explicit. And they find reasons for this.

Any theory however elegant that may be from mathematical point of view remains as a nice theory so long as some experiments come up supporting the veracity of the theory. In 1921 there were experimental supports in both favour of STR and GTR yet the Nobel Committee in Physics had a different view. It appears on one hand they felt that the prize for Einstein was already overdue while on the other hand the theories of relativity yet to be a comfortable one not only with the physicists but with the scientific community.

**First phase of nominations favouring Einstein**

Albert Einstein received altogether 66 nominations, all for Physics Nobel, out of which 64 were between 1910 and 1922 and a bit surprisingly two more in 1923. He received the first nomination in 1910 and the only nomination of that year in his favour came from Wilhelm Ostwald (1853-1932), who had just won the 1909 Chemistry Nobel Prize. As such, nowadays possibly a good number of nominations come from previous Nobel Laureates in the same area as they are bestowed with that right once they have been awarded the Prize. Some additional frontline scientists also receive request from the Nobel Committee for submitting nominations. However, if we look back to a time when Nobel Prize was barely a decade old and had very limited number of actual Prize winners; the reputed scientists formed a significant portion of the nominators in various disciplines. And at the time, but not now, a Nobel laureate in Chemistry was considered eligible to nominate one for physics prize.

So when Einstein received his first nomination the scientific community was aware of his theory of photoelectric effect and the Special Theory of Relativity both of which were then five years old. General theory of Relativity was yet to come up. This may safely be deducted that the nomination of Ostwald was based on one or more of those 1905 works that ultimately fetched the Prize for Einstein more than a decade later of the first nomination.

**Wilhelm Ostwald**

**Wilhelm Wein**

Einstein received his next two nominations in 1912 while 1911 went blank. 1912 recommendations were sent by Clemens Schaefer and Wilhelm Wien. Both were German scientists and Wien himself turned into a Physics Nobel laureate in 1911. The year 1913 could see three nominations in favour of Einstein from Bernhard Naunyan and two previous nominators Ostwald and Wien. We can include the 1914 nominations as pre-war ones as the First World War broke out in August 1914 while the dispatching of nominations used to get over (and that tradition still continues) by January end of the respective year of the Prize. These two nominations of

1914 were sent by Orest Khvol´son and Bernhard Naunyan who sent it for the second time in two years. So, one can conclude that Einstein had no less than eight nominations till 1914, before the outbreak of First World War. During the War the process of awarding Prize went in a low key and the relationship between Germany and other scientifically advanced nations like France, England, Italy, Belgium and Netherlands hit a new low with the USA getting into the scenario as a new player. And GTR was yet to be proposed by Einstein. If someone feels the number of nominations were inadequate for the selection of a Prize one can only point out when the Dutch physical chemist J.D. Van deer Waals won the Physics Nobel Prize of 1910 there was one single nomination for his favour in that year.

However, it needs to be put on record that even before the First World War began the nominations that the Nobel Committee received in favour of Einstein bore a significant nationalistic footprint. For example, all the six nominators who altogether submitted eight nominations till 1914 were all German. Wilhelm Ostwald was born in a German family in Estonia and had his education there. But he spent nearly entire part of his academic career in Leipzig University in Germany. He was a chemist of repute and he went on to nominate Einstein again in 1912 and in 1913. Among the other pre-war nominators Bernhard Naunyan (1939-1925) was a German experimental pathologist. He was born in 1839 and was senior to Einstein by 40 years! It is difficult to know about his connection with physics but he sent two nominations favouring Einstein in 1912 and in 1914 and then again in 1922 when he was more than eighty years old. Clemens Schaefer (1878-1968) was once again a German physicist who later took interest in atmospheric science. He was virtually of Einstein's age being born one year earlier than Albert. Orest Khvol´son (1852-1936) happens to be the only non-German to send a nomination for Einstein before the First World War. He was a Russian physicist and was a professor at St Petersburg University. He had interest in different branches of physics and visited different countries including Germany. We are not sure if all these eight nominations in favour of Einstein mentioned Special Theory of Relativity along with the other works of Einstein.

**Patterns in the nominations of the first phase**

It appears that the nominators might have found it difficult to mention STR in their nominations as most in the scientific community felt this to be a fancy theory. However the only but very strong proof in favour of the constancy of the speed of light as envisaged in STR was on the basis of Michelson-Morley Experiment. In reality it actually happened the other way round. The null results of Michelson-Morley Experiment prompted Einstein to propose the constant velocity of light irrespective of the motion of the reference frame that was the part of the postulates in STR. Of course, the idea of time dilation was also there but it was not possible to have an experimental support in favour of that at that time. However, back in 1727 when Bradley was trying to find out the speed of light based on the observations of the eclipse of a star he came across what is referred to as 'stellar aberration' that is actually connected to time dilation. Another revolutionary concept, the mass-energy equivalence that was put forward in another 1905 paper could only be realized once the accurate determination of nuclear masses could be made and subsequently the theory for nuclear fission was developed.

There was no nomination for Einstein in 1915 and only one in 1916 from Felix Ehrenhaft (1879-1952) possibly because of the nasty phase of the War. The German speaking Austrian physicist Ehrenhaft was young, exactly of Einstein's age, and had a personal friendship with Einstein. In 1916 GTR had already come out but as we know it was beyond the comprehension of most in the scientific community at that time. Moreover this being a theory with no experimental support at that time physicists apparently looked at it with raised eyebrows.

In 1918 the World War was over only at the end of the year and it is not surprising that Einstein received all six nominations on that year once again all from German

scientists only. There was no nomination from the scientists from other nationalities and it possibly indicates the fallout of the First World War the memory for which was very bitter for everybody. Total number of nominations till 1919 is given in the table below. We need to remember that the observations of Sir Arthur Eddington during the total solar eclipse of 1919 placed Einstein's GTR in a strong foundation through the critical observation of a natural phenomenon like the total solar eclipse yet at that time not many in the scientific community were convinced about the correctness of GTR. Einstein himself was not much impressed with the data collected by Eddington. However, GTR was applied for making the corrections in the perihelion precession of the planet Mercury. The orbit of Mercury was known to show a deviation from its expected path that could not be explained with the help of Newtonian Mechanics. This led among other things, to the assumption of another planet even closer to the Sun influencing the orbit of Mercury. However that could never be detected. Now the GTR could calculate and establish that the discrepancy is one due to the influence of the huge gravitational field of the sun leading to the curvature of the space-time around the Mercury the planet nearest to the sun. The deviation from the expected orbit could actually be explained in a nice way. The relevant calculations turned out to be so exact in its explanation that most felt had GTR be proved incorrect from other considerations in future; it would be very difficult to find out another suitable theory to explain this perihelion precession of Mercury with so much accuracy. This result on Mercury orbit came to be known in 1916 and this may be considered to be a test, in support of the GTR. The following table gives the 25 nominations that Einstein received till 1919 where GTR possibly could not influence the nominators. We shall see how the nomination scenario changed both

**25 Nominations favouring Albert Einstein received by the Nobel Committee on Physics upto 1919**

| Sl no | Name of the nominator | Lifespan | Year of 1st nomination | Nationality | Further nomination | Remarks |
|---|---|---|---|---|---|---|
| | | | | | | |
| 1. | Wilhelm Ostwald | 1853 – 1932 | 1910 | German | 1912, 1913, | NL Chem 1909 |
| 2. | Clemens Schaufer | 1878 - 1968 | 1912 | German | | |
| 3 | Wilhelm Wien | 1864 - 1928 | 1912 | German | 1913, 1918 | NL Phys 1911 |
| 4. | Ernst Pringsheim | 1859 - 1917 | 1912 | German | | |
| 5. | Bernhard Naunyan | 1839 - 1925 | 1913 | German | 1914 | |
| 6. | Orest Khovolson | 1852 - 1934 | 1914 | Russian | | |
| 7. | Felix Ehrenhaft | 1879 - 1952 | 1916 | Austrian | 1918 | |
| 8. | Arthur Hass | 1884 - 1941 | 1917 | Austrian | | |
| 8. | Emil Warburg | 1846 - 1931 | 1917 | German | 1918, 1919 | |
| 10. | Pierre Weiss | 1865 - 1940 | 1917 | French | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 11. | Stefan Meyer | 1872 - 1949 | 1918 | Austrian | | |
| 12. | Max von Laue | 1879 - 1960 | 1918 | German | 1919 | NL Phys 1914 |
| 13. | Edger Meyer | 1879 - 1960 | 1918 | German | 1919 | |
| 14. | Svante Arrhenius | 1859 – 1927 | 1919 | Swedish | | NL Chem 1903 |
| 15. | Max Planck | 1858 -1947 | 1919 | German | | NL Phys 1918 |

qualitatively and quantitatively after 1919.

### Second phase of nominations

One can see that these 25 nominations came from 15 scientists and there were five Nobel laureates (in Physics or in Chemistry) when they sent their nominations. The nominators were all Europeans and were overwhelmingly German. Einstein received altogether 39 nominations in the three years of 1920, 1921, 1922 the year his Physics Nobel Prize for 1921 was announced. Two more nominations marked for 1923 in all probability received by the Nobel Committee before the announcement of Einstein Nobel in 1922. A lot of scientists from various countries nominated Einstein, during these three years and most of them did not do this earlier. Once again we should keep in mind that the deadline for sending a particular year's nomination is the end of January of the concerned year.

Now we can possibly conclude that a significant number of these scientists were impressed by the observations made by Eddington during the total solar eclipse of July 1919. During the total solar eclipse the sighting of the stars that otherwise remain covered by the burning disc of the sun is a major observation in support of the GTR. It was only possible because of the bending of light beam coming from those stars took place owing to the huge gravitational field of the sun as predicted in the GTR. This could definitely add a special dimension to the theory and the involvement of a British Scientist in the form of Arthur Eddington added a special dimension to the entire story. The First World War was just over and a

**Scientists who nominated Einstein only during 1920 - 1922**

| Sl no | Name of the nominator | Lifespan | Year of 1st nomination | Nationality | Later nomination | Remarks |
|---|---|---|---|---|---|---|
| 1. | Niels Bohr | 1885 -1962 | 1920 | Danish | | NL Phys 1922 |
| 2. | Wilhelm Julius | | 1920 | Dutch | | |
| 3. | H Kamerlingh Ones | 1853 - 1926 | 1920 | Dutch | | NL Phys 1913 |
| 4. | Hendrik Lorentz | 1853 - 1928 | 1920 | Dutch | | NL Phys 1902 |
| 5. | Leonard Orenstein | 1880 - 1941 | 1920 | Dutch | | |

| Sl no | Name of the nominator | Lifespan | Year of 1st nomination | Nationality | Later no-mination | Remarks |
|---|---|---|---|---|---|---|
| 1. | Niels Bohr | 1885 -1962 | 1920 | Danish | | NL Phys 1922 |
| 2. | Wilhelm Julius | | 1920 | Dutch | | |
| 3. | H Kamerlingh Ones | 1853 - 1926 | 1920 | Dutch | | NL Phys 1913 |
| 4. | Hendrik Lorentz | 1853 - 1928 | 1920 | Dutch | | NL Phys 1902 |
| 5. | Leonard Orenstein | 1880 - 1941 | 1920 | Dutch | | |
| 6. | W von Wieldier Hartz | 1836 - 1921 | 1920 | German | | Anatomist |
| 7. | Pieter Zeeman | 1865 - 1943 | 1920 | Dutch | | NL Phys 1902 |
| 8. | Carl Charlier | 1862 -1934 | 1921 | Swedish | | |
| 9. | Hans Dallenbach | | 1921 | German | | |
| 10. | Sir Arthur Eddington | 1882 - 1944 | 1921 | British | | |
| 11. | Jaques Hadamard | 1865 - 1963 | 1921 | French | 1922 | Mathematician |
| 12. | George Jaffe | 1880 - 1965 | 1921 | Russ, US | | Chemist |
| 13. | Theodere Lyman | 1874 - 1954 | 1921 | US | | |
| 14. | Erich Marx | 1874 - 1956 | 1921 | German | | |
| 15. | Gunner Nordstorm | 1881 - 1923 | 1921 | Finnish | 1922 | |
| 16. | Carl Wilhelm Ossen | 1879 - 1944 | 1921 | Swedish | 1922 | |
| 17. | Charles Wallcott | 1850 - 1927 | 1921 | US | | Paleontologist |
| 18. | Otto Weiner | 1862 - 1927 | 1921 | German | | |
| 19. | Marcell Brilloiun | 1854 - 1948 | 1922 | French | | |
| 20. | Theophile de Donder | 1872 - 1957 | 1922 | Belgian | | |
| 21. | J. Robert Emden | 1862 - 1940 | 1922 | Swiss | | |
| 22. | Paul Langevin | 1872 - 1946 | 1922 | French | | |
| 23. | Edward B. Poulton | 1856 - 1943 | 1922 | British | | Biologist |
| 24. | Arnold Sommerfield | 1868 - 1951 | 1922 | German | | |
| 25. | Ernst Wagner | 1876 - 1928 | 1922 | German | | |

scientist putting up a great effort in checking out the reliability of a theory proposed by one from the so called enemy nation had a subtle impact in the episode. So, in most likelihood, Einstein now (from 1920 onwards) began to receive nominations for his GTR, may be along with for his other works. The following table is based on the nominations from the scientists who nominated Einstein only after 1919. This shows that the scientists from different countries and those who did not nominate Einstein earlier came up with nominations and some did it more than once in these three years. Of course there were a few scientists who submitted nominations in pre 1920 but came up with fresh nominations during these three years. They happened to be all German scientists and their enthusiasm for Einstein was quite evident. For example Wilhelm von Waldeyar Hartz was a German anatomist and apparently had no connection with physics. He sent a nomination favouring Einstein in 1921 when he was 85 years old. In fact he did not live to see Einstein getting selected for the Nobel Prize as he passed away in January 1921 indicating that the nomination was submitted just before his death.

During these three years (1920-1922) 11 more nominations in favour of Einstein were also sent by the scientists who nominated him before this period (1920-1922). They are all German scientists and the list includes Emil Warburg (20, 21, and 22); Max Planck (21, 22); Arthur Hass (21); Max von Laue (22); Bernhard Naunyan (22); Edger Meyer (22); Stefan Meyer (22); Felix Ehrenhaft (22). However there were two more nominations sent in favour of Einstein in the year 1923. The nominators were Austrian physicist Gustav Jaeger (1865 – 1938) and 1920 Chemistry Nobel winner Walther Nernst (1864 – 1941) of Germany. It is not unlikely that actually these two scientists sent their nominations in September-October 1922 immediately after the opening of the nomination window for the 1923 prizes. The 1921 physics Nobel for Einstein (1921) and 1922 for Bohr were announced in November 1922. So technically the nominations from these two scientists became the parts of the 1923 physics nominations. It is very unlikely that they sent these nominations immediately after the announcement of Einstein Noble prize.

**Plank and Einstein**

**Neils Bohr**

## View of the Nobel Committee on theories of relativity made public

Interestingly, Einstein went in a pre-scheduled lecture tour to Japan by skipping the Nobel Prize distribution function at Stockholm in December 1922. Einstein definitely did not lose interest in the Nobel Prize though it was really delayed for him. His absence from the function may look a bit surprising because Einstein promised his divorced first wife Mileva the entire prize money if he would be winner of Nobel Prize, and he kept his promise. The presentation speech at the function was delivered by the Nobel Laureate Swedish chemist Svante Arrhenius. Apparently he offered some sort of a justification for not considering the theories of relativity in the citation. As a very important figure in the Swedish Academy of Sciences Arrhenius possibly considered the GTR as a new philosophy as it also drew the attention of that community. First couple of lines of the presentation speech is worth quoting here so that one can form his or her own opinion. Arrhenius began, "There is probably no physicist living today whose name has become so widely known as that of Albert Einstein. Most discussion centres on his theory of relativity. This pertains essentially to epistemology and has therefore been the subject of lively debate in philosophical circles". The first paragraph however ends with the sentence; "the theory in question also has astrophysical implications which are being rigorously examined at the present time." So the Nobel Committee in Physics felt that the theories of relativity

have got more to do with philosophy even when acknowledging the "theory in question" i.e. GTR "has astrophysical implications". This is possibly regrettable.

## Could Einstein receive a second Nobel Prize in physics?

Before we conclude we must touch upon this point. We have already mentioned how one should look at the two 1923 nominations. So it may be observed that the nominations favouring Einstein effectively came to a dead end immediately after the announcement of his 1921 Physics Nobel Prize in 1922. Now it was in the public domain that Einstein had not received the prize explicitly for STR and GTR. Rather in 1922 the Nobel Committee in a way pushed those theories into the domain of philosophy. A section of the physics community felt that the Nobel Committee deliberately left this part open and wanted to take some more time before STR and GTR collect more experimental evidences in their favour. Since the Prize was not unambiguously awarded for the two most famous contributions of Einstein that in a way, kept the door open for another future Nobel Prize of Einstein on his theories of relativity. Particularly it was known as per the condition laid down by Alfred Nobel that one single work cannot be awarded twice with a Nobel Prize even if that work turns out to be of great significance over time. Incidentally, or may be unfortunately, there was not a single nomination favouring Einstein after 1922-1923. Einstein moved to USA in early 1933 and stayed there more than 22 years before he passed away there in 1955. Nuclear fission was a disturbing reality during the Second World War. It showed what could be done based on an innocent looking 1905 equation $E = mc^2$.

On the other hand unexpectedly large number of muons that are moving with a speed of 0.99c and are having a half life of 2.197 μs could be detected on the surface of the earth in 1941 by Bruno Rossi and D.B. Hall. This experimental findings could be explained using time dilation introduced in STR. Time was moving at different rates on the frame of the particle that was moving with a velocity that was just about 1% less than that of light and on the earth frame where the observer was placed. That made the detection of muons possible on the earth. However, the great role of both STR and GTR in making the finer corrections in the atomic clocks placed on the artificial satellites moving round the earth leading to the precision with which a GPS can function today came much later on after the demise of Einstein.

## Concluding observations

After the theories of relativity and Nobel Prize Albert Einstein was a scientist of global standing yet something possibly went wrong with the deep inside the mind of the entire scientific community spread all over the world. Due to some reason or other any physicist or for that matter any scientist from the either side of Atlantic did not nominate Einstein for a second Nobel Prize. The example of Marie Curie winning a second Nobel Prize was already before them, yet the Nobel committee cannot be criticized in this case as Einstein received no further nomination. Second World War and the making of atom bomb possibly had to do something with it or we may try to conjecture the other reasons for this, but it has remained a mystery. The views held by the physics community of that phase demands a more critical study in the backdrop of the geo-political equations of the period between Einstein's Nobel announcement in November 1922 and his passing away in 1955 for an acceptable answer to the puzzle.

**References:**

1.https://www.nobelprize.org/prizes/physics/1921/einstein/nominations/

2.https://www.nobelprize.org/prizes/physics/1921/ceremony-speech/

3.Various entries from en.wikipedia.org

# Electron Spin Resonance – A pedagogical analysis

**D. Syam**[1,2]

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## Abstract

*When an electron is placed in a magnetic field, it gains or loses some energy by virtue of possessing a magnetic dipole moment. This happens both for free and bound electrons. For a bound electron the change of energy depends on the magnetic field, the total angular momentum quantum number (j) as well as the orbital angular momentum quantum number (l). To be precise, the change in the general case is determined by the magnetic quantum number ($m_j$) and a quantity called the Lande g-factor - which depends on j and l - together with the magnetic field H. When l =0, and the interactions of an electron with its environment are ignored, the theoretically expected value of g is 2. The measured value of g then bears an imprint of the environment. For paramagnetic solids, the most accurate measurement of g is achieved by employing a magnetic resonance technique pioneered by the Russian physicist Y. K. Zavoisky. In this experimental method, transitions between the two magnetic states corresponding to $m_j = m_s = \pm ½$ are induced by an oscillating electromagnetic field, with a frequency $\nu \sim 10$ MHz. The transition rate has a peak value when $h\nu = g\mu_B H$, where h is Planck's constant and $\mu_B$, called the Bohr magneton, is a constant associated with atomic magnetic dipole moments. This phenomenon is referred to as electron spin resonance (ESR).Thus by finding out the value of H required to produce the resonance condition, corresponding to a pre-selected value of ν, the value of g can be determined. A similar method, namely the nuclear magnetic resonance (NMR) technique, is widely used to study magnetic properties of atomic nuclei. In this article we explain, in details, the Physics behind the electron spin resonance technique of Zavoisky.*

## Introduction

The aim of this article is to expound the principle of 'electron spin resonance' to M. Sc. students and laboratory instructors.

The theory presented here is semi-classical in nature and the diagrams are basically schematic. Throughout this article or note, c.g.s (e. m. u.) units have been used.

The angular momentum of an electron $\boldsymbol{j} = \boldsymbol{l} + \boldsymbol{s}$ (all in units of $\hbar$). Its magnetic dipole moment, on the other hand, is

$$\boldsymbol{\mu} = -\mu_B (\boldsymbol{l} + 2\boldsymbol{s})$$

where $\mu_B = e\hbar/2m_e$, is the Bohr magneton, $e$ being the magnitude of the charge of an electron. See Fig.1. The 'effective value' of the magnetic moment (component along $\boldsymbol{j}$) is

$$\boldsymbol{\mu}_{\text{eff}} = -g\mu_B \boldsymbol{j}$$

where $g$, called the 'Lande $g$-factor' is given by

$$g = 1 + \frac{j(j+1) + s(s+1) - l(l+1)}{2j(j+1)}$$

with $j = l \pm \frac{1}{2}$ , since $s = \frac{1}{2}$ . For an electron in the 's'-state, $l$ = 0; hence $j = \frac{1}{2}$ and $g$ =2. Such an electron can be found in the second nitrogen atom away from the di-phenyl end of the diphenyl picryl hydrazyl (DPPH) molecule.

Equation of motion: In the presence of a constant magnetic field $H_c$ in the Z-direction (say), the direction of the angular momentum ($\boldsymbol{j}$) keeps turning around the Z-axis.

$$\hbar \frac{d\boldsymbol{j}}{dt} = \boldsymbol{\mu}_{\text{eff}} \times \boldsymbol{H}_c$$

or

$$\frac{d}{dt}(\boldsymbol{\mu}_{\text{eff}}) = \gamma\,(\boldsymbol{\mu}_{\text{eff}} \times \boldsymbol{H}_c)$$

where $\gamma = -g(e/2m_e)$. The turning or precession of $\boldsymbol{j}$ (or $\boldsymbol{\mu}_{\text{eff}}$) occurs with angular frequency $\omega_L = \gamma H_c$ . Its magnitude, $|\omega_L|$, is referred to as the Larmor (precessional) frequency. See Fig.2.

Consider all the $N$ electrons in the same quantum state (say the s-state) in a small volume $\Delta V$ of the sample and define the intensity of magnetization $\boldsymbol{M}$ by $\boldsymbol{M}\Delta V = \Sigma\, \boldsymbol{\mu}_{\text{eff,i}}$ (i =1,2...$N$). Then the evolution of $\boldsymbol{M}$ is governed by

$$\frac{d}{dt}(\boldsymbol{M}) = \gamma\,(\boldsymbol{M} \times \boldsymbol{H}_c)$$

For $\boldsymbol{H} = \boldsymbol{H}_c + \Delta\boldsymbol{H}(t)$, the equation of motion of $\boldsymbol{M}$ is

$$\frac{d}{dt}(\boldsymbol{M}) = \gamma\,(\boldsymbol{M} \times \boldsymbol{H})$$

If the 'perturbation' is switched off at some time t, the x- and y-components ($M_x$ , $M_y$) of $\boldsymbol{M}$ should disappear and $M_z$ should approach a constant value (= $M_c$ , say). The simplest 'phenomenological' way of capturing this change is to introduce the relaxation time approximation:

$$\frac{d}{dt}(M_z) = \gamma\,(\boldsymbol{M} \times \boldsymbol{H})_z + \frac{M_c - M_z}{\tau_1}$$

$$\frac{d}{dt}(M_x) = \gamma\,(\boldsymbol{M} \times \boldsymbol{H})_x - \frac{M_x}{\tau_2}$$

$$\frac{d}{dt}(M_y) = \gamma\,(\boldsymbol{M} \times \boldsymbol{H})_y - \frac{M_y}{\tau_2}$$

The relaxation times for the parallel component of $\boldsymbol{M}$ (i.e. $M_z$) and the perpendicular components of $\boldsymbol{M}$ ($M_x$ , $M_y$) – $\tau_1$, $\tau_2$ respectively -are different, in general; $\tau_1$ is determined by spin-lattice interaction while $\tau_2$ is supposed to depend on spin-spin interaction.

Consider now a perturbation $\Delta\boldsymbol{H}(t) = 2H_0 cos\omega t\boldsymbol{i}$. It can be written as the sum of a clockwise and an anti-clockwise rotating vector, each of amplitude $H_0$:

$$2H_0 cos\omega t\boldsymbol{i} = (H_0 cos\omega t\boldsymbol{i} - H_0 sin\omega t\boldsymbol{j}) + (H_0 cos\omega t\boldsymbol{i} + H_0 sin\omega t\boldsymbol{j}) \equiv \boldsymbol{H}_{\text{cw}} + \boldsymbol{H}_{\text{anti-cw}}$$

The clockwise rotating component, $\boldsymbol{H}_{\text{cw}}$, follows the precessing $\boldsymbol{\mu}_{\text{eff}}$ vector (see Fig. 3); and, if $\omega = \omega_L$, tracks it perfectly. In the rest frame of the vector $\boldsymbol{H}_{\text{cw}}$, $\boldsymbol{\mu}_{\text{eff}}$ might now have appeared stationary; however precession around $\boldsymbol{H}_{\text{cw}}$ will pull it over to the other side signalling a transition from one energy state to another (- lower to higher magnetic energy state, implying absorption of energy from the oscillating radio-frequency field).See Fig. 4. No such transition can be induced by $\boldsymbol{H}_{\text{anti-cw}}$.
In considering the dynamics of the system, we may, therefore, ignore the effect of $\boldsymbol{H}_{\text{anti-cw}}$.

Bloch's equations

Replacing $\boldsymbol{H}$ by $\boldsymbol{H}_{\text{eff}} = \boldsymbol{H}_{\text{c}} + \boldsymbol{H}_{\text{cw}}$ we can rewrite the equations of evolution of $\boldsymbol{M}$. We thus arrive at Bloch's equations.

$$\frac{dM_z}{dt} = \gamma\left[-M_x H_0 sin\omega t - M_y H_0 cos\omega t\right] + \frac{(M_c - M_z)}{\tau_1} \quad (M_c \equiv \chi_c H_c) \qquad (1)$$

$$\frac{dM_x}{dt} = \gamma\left[M_y H_c + M_z H_0 sin\omega t\right] - \frac{M_x}{\tau_2} \qquad (2)$$

$$\frac{dM_y}{dt} = \gamma[M_z H_0 cos\omega t - M_x H_c] - \frac{M_y}{\tau_2} \qquad (3)$$

Solution of the equations:

Assume that $M_z$ becomes constant in the long run (steady state). This can happen if

$$M_x = Asin\omega t + Bcos\omega t \qquad (4)$$

$$M_y = Acos\omega t - Bsin\omega t \qquad (5)$$

so that

$$M_x H_0 sin\omega t + M_y H_0 cos\omega t = AH_0$$

Hence

$$\frac{dM_z}{dt} = -\gamma A H_0 + \frac{(M_c - M_z)}{\tau_1}$$

or

$$\frac{dM_z}{dt} + \frac{M_z}{\tau_1} = \frac{M_c}{\tau_1} - \gamma A H_0$$

Obviously, then, the value of $M_z$ in the steady state ($M_{z,s}$) is

$$M_{z,s} = M_c - \tau_1 \gamma A H_0 \tag{6}$$

Again, from eqs. (2), (4) and (5),

$$\omega A cos\omega t - \omega B sin\omega t = \gamma\left[(A cos\omega t - B sin\omega t)H_c + M_{z,s}H_0 sin\omega t\right] - \frac{A sin\omega t + B cos\omega t}{\tau_2} \tag{7}.$$

Equating coefficients of $cos\omega t$ on the two sides

$$\omega A = \gamma H_c A - \frac{B}{\tau_2} \tag{8}$$

Similarly, equating coefficients of *sinωt*, we get

$$-\omega B = \gamma M_{z,s} H_0 - \frac{A}{\tau_2} - \gamma B H_c \tag{9}$$

Identical equations can be obtained from eqs. (3), (4) and (5). From eq.(9),

$$B = \frac{\gamma M_{Z,s} H_0 - \frac{A}{\tau_2}}{\gamma H_c - \omega} = \frac{\gamma (M_c - \tau_1 \gamma A H_0) H_0 - \frac{A}{\tau_2}}{\gamma H_c - \omega} \tag{10}$$

Using eq. (10) in eq. (8) we get

$$A = \frac{\gamma M_c H_0 \tau_2}{\tau_2^2 (\gamma H_c - \omega)^2 + \tau_1 \tau_2 \gamma^2 H_0^2 + 1} \tag{11}$$

From eq. (10),

$$B = \frac{\gamma M_c H_0 - (\tau_1 \gamma^2 H_0^2 + \frac{1}{\tau_2})A}{\gamma H_c - \omega}$$

or

$$B = \frac{\gamma M_c H_0 \left[\tau_2^2 (\gamma H_c - \omega)^2 + \tau_1 \tau_2 \gamma^2 H_0^2 + 1 - (\tau_1 \gamma^2 H_0^2 + \frac{1}{\tau_2})\tau_2\right]}{(\gamma H_c - \omega)(\tau_2^2 (\gamma H_c - \omega)^2 + \tau_1 \tau_2 \gamma^2 H_0^2 + 1)}$$

i.e.

$$B = \frac{\gamma \tau_2^2 M_c H_0 (\gamma H_c - \omega)}{(\tau_2^2 (\gamma H_c - \omega)^2 + \tau_1 \tau_2 \gamma^2 H_0^2 + 1)} \tag{12}$$

Using the definition of $\gamma$, viz. $\gamma = g(e/2m_e) \approx \omega_L / H_c$ (as $H_0 \ll H_c$), $\omega_L$ being the Larmor frequency, we have

$$A = \frac{\gamma M_c H_0 \tau_2}{\tau_2^2(\gamma H_c - \omega)^2 + \tau_1 \tau_2 \gamma^2 H_0^2 + 1}$$

$$\approx \chi_c \omega_L \tau_2 \times \frac{H_0}{\tau_2^2(\omega_L - \omega)^2 + \tau_1 \tau_2 \gamma^2 H_0^2 + 1} \qquad (13)$$

Similarly

$$B \approx \chi_c \omega_L \tau_2 \times \frac{(\omega_L - \omega)\tau_2 H_0}{\tau_2^2(\omega_L - \omega)^2 + \tau_1 \tau_2 \gamma^2 H_0^2 + 1} \qquad (14)$$

Finally

$$M_x \approx \frac{1}{2}\chi_c \omega_L \tau_2 \times \frac{2(\omega_L - \omega)\tau_2 H_0 cos\omega t + 2H_0 sin\omega t}{\tau_2^2(\omega_L - \omega)^2 + \tau_1 \tau_2 \gamma^2 H_0^2 + 1}$$

$$\equiv \chi'(2H_0 cos\omega t) + \chi''(2H_0 sin\omega t)$$

where $\chi'(\chi'')$ is the real (imaginary) part of the magnetic susceptibility. Both $\chi'$ and $\chi''$ are functions of the frequency $\omega$. Note that when

$$\boldsymbol{H} = H_c \boldsymbol{k} + (2H_0 cos\omega t)\boldsymbol{i}$$

the value of the intensity of magnetization $\boldsymbol{M}$ (in complex-number form) is

$$\boldsymbol{M} = \boldsymbol{\chi_c} H_c \boldsymbol{k} + 2\chi^* H_0 e^{i\omega t}\boldsymbol{i}$$

where

$$\chi^* = \chi' - i\chi''$$

and $\chi_c$ is the static susceptibility(independent of $\omega$).Thus the magnetic energy dissipated per unit volume per second is*

$$Q = \frac{\omega}{2\pi}\oint \boldsymbol{H} \cdot d\boldsymbol{M} = 2\omega\, \chi'' H_0^2$$

The value of $M_{z,s}$ :

$$M_{z,s} = M_c - \tau_1 \gamma A H_0$$

$$= \chi_c H_c \times \frac{1 + \tau_2^2(\omega_L - \omega)^2}{\tau_2^2(\omega_L - \omega)^2 + \tau_1 \tau_2 \gamma^2 H_0^2 + 1}$$

Graphs of variations of $\chi'$ and $\chi''$ as functions of $\omega$ are given in Dekker's book. From the graphs (or the formulas) for these quantities it is clear that $\chi'$ behaves 'anomalously' near $\omega_L$, and $\chi''$ has a peak at $\omega_L$ as expected in a *resonance* phenomenon.

The real and imaginary parts of $\chi$ are actually related via the Kramers-Kroenig dispersion relations (See Jackson's Classical Electrodynamics or Dekker's book). Notice that $M_{z,s}$ is smaller than $M_c$. This is due to the pumping action of the oscillating magnetic field, which puts more electrons in the higher energy state ($\boldsymbol{\mu}_{\text{eff}}$ opposite to $\boldsymbol{H}$), through absorption of energy, than the case when there is no such oscillating field.

The actual experimental arrangement is shown in Fig. 5. See reference no. 3 for details of the experimental procedure.

## Conclusion

Determination of the Lande *g*-factor for an unpaired electron in the $l = 0$ state by Zavoisky's technique is now a standard prescribed experiment in the post-graduate Physics syllabi of Indian universities. In the course of explaining to the I-Ph. D. students of the Bose Institute the principles involved in the measurement of *g*, we have felt the acute need for an article that collects together the relevant study materials. We have attempted to do just that. It is meant to complement the material presented in manuals furnished by the manufacturers of the instrument. Hope the students and teachers (laboratory instructors) would find the article useful.

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* See the Appendix for an alternative derivation.

## References

1. The theory, given here, is an elaboration of the treatment developed in: Solid State Physics – A. J. Dekker.

2. The quantum mechanical theory, without the relaxation mechanisms, is given in: Modern Quantum Mechanics – J. J. Sakurai

3. The experimental arrangement depicted in Fig. 5 is described in:

www.iitr.ac.in/uploads/CMP (4. Electron spin resonance (ESR).pdf – IIT Roorkee)

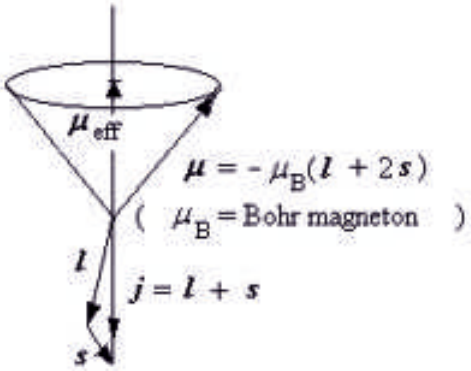


Fig. 1

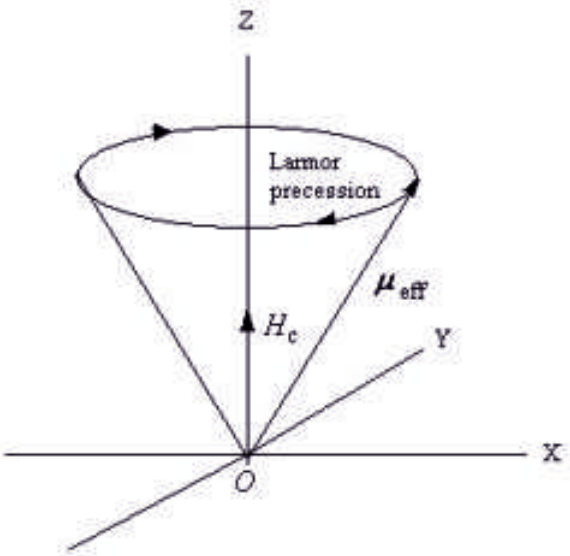


Fig. 2

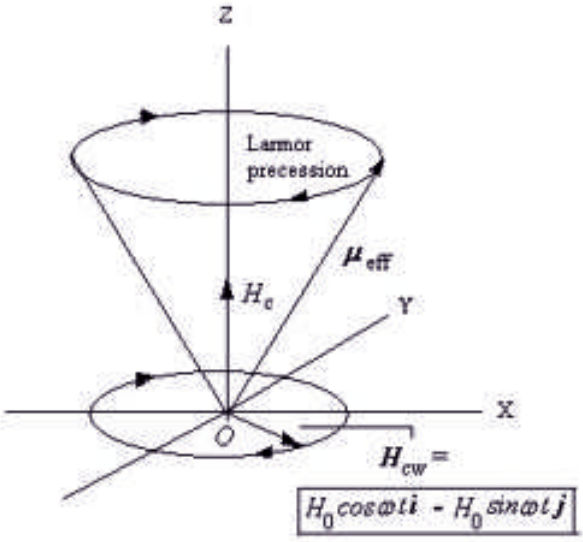


Fig. 3

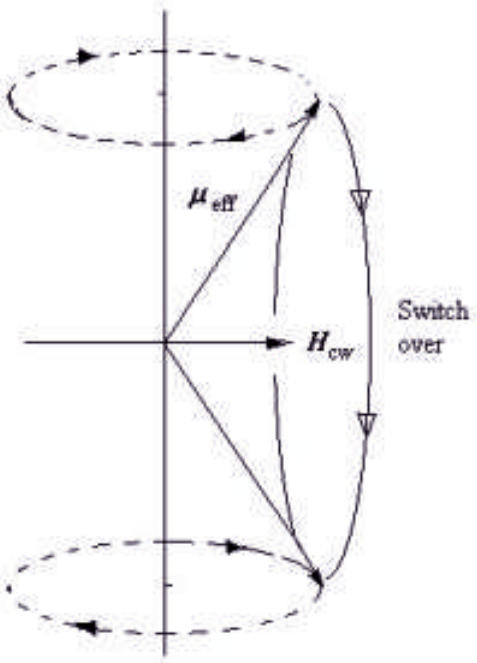


Fig. 4

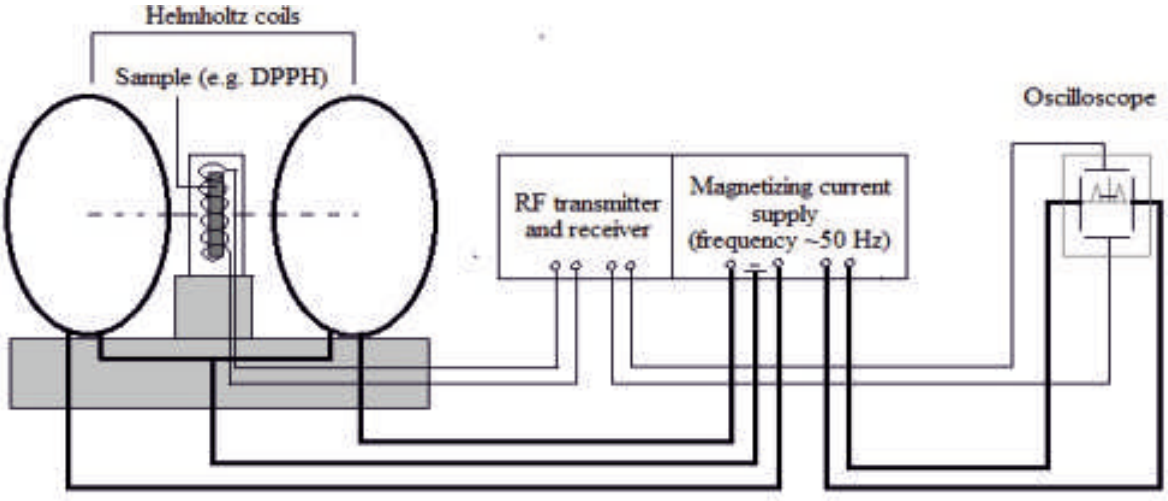


Fig. 5

## Appendix

Alternative calculation of hysteresis loss:

Considering only the co-rotating component of the radiofrequency magnetic field (that induces the transitions) together with the constant magnetic field

$$\boldsymbol{H} = H_c\boldsymbol{k} + H_0 cos\omega t\boldsymbol{i} - H_0 sin\omega t\boldsymbol{j}$$

As before, magnetization ($\boldsymbol{M}$) is given by

$$\boldsymbol{M} = \chi_c H_c\boldsymbol{k} + [\chi'(2H_0 cos\omega t) + \chi''(2H_0 sin\omega t)]\boldsymbol{i} + [\chi''(2H_0 cos\omega t) - \chi'(2H_0 sin\omega t)]\boldsymbol{j}$$

Thus the hysteresis loss/ cycle is

$$Q = \frac{\omega}{2\pi}\oint \boldsymbol{H}\cdot d\boldsymbol{M}$$

or

$$Q = \frac{\omega}{2\pi}\int_0^T [H_0 cos\omega t\boldsymbol{i} - H_0 sin\omega t\boldsymbol{j}] \cdot \{[\chi'(-2H_0\omega sin\omega t) + \chi''(2H_0\omega cos\omega t)]\boldsymbol{i} + [\chi''(-2H_0\omega sin\omega t) - \chi'(2H_0\omega cos\omega t)]\boldsymbol{j}\}dt$$

$$= \frac{\omega}{2\pi}\cdot 2H_0^2\omega\cdot\int_0^T \{cos\omega t(\chi'' cos\omega t - \chi' sin\omega t) + sin\omega t(\chi'' sin\omega t + \chi' cos\omega t)\}dt$$

$$= \frac{\omega}{2\pi}\cdot 2H_0^2\omega\cdot\frac{2\pi}{\omega}\cdot\left[\frac{1}{2}\chi'' + \frac{1}{2}\chi''\right] = 2\omega\chi'' H_0^2$$

This is identical to what we have derived earlier.

(Thanks are due to Dr. Swapan Kumar Saha for suggesting this alternative approach.)

# Dr. D.P. KHANDELWAL: BEYOND IAPT

## A Conscious Teacher

It was June 1964. After doing M.Sc. from Allahabad University, I had applied for the post of lecturer in Physics in Agra College and was called for the interview. Principal, Agra College, Prof. M. Ray, Head, Physics Department Dr. D.P. Khandelwal and a Subject Expert were committee members.. Dr Khandelwal was a man of spectroscopy and he was asking some questions on X-ray spectroscopy. I answered well. Then suddenly Prof. Ray said, I have seen him - he has been my student ( I had passed my B.Sc. degree from Agra College and I had few opportunities to meet Prof. Ray). I was selected and joined Agra College. Dr. Khandelwal was a conscious teacher. He called upon me and discussed my teaching priorities and assigned to teach Mathematical Physics to M.Sc., Properties of Matter to B.Sc., and Practical Physics to Class XII.

## Pragmatic Personality

It so happened that I got the Junior Fellowship for doing D.Phil. Degree in Allahabad University. I conveyed this message to Dr. Khandelwal. He was happy but showed his concern about me. He advised that you have got permanent job in prestigious Agra College. You can continue your research work here in spectroscopy along with post graduate teaching; you will have a bright carrier. Further he suggested that you also talk to Prof. Ray who is well known for his work in mathematics and he is an authority to accept your resignation letter. While I talked to Prof. Ray, he suggested that you join Allahabad University for your D.Phil. Degree. I talked to Dr. Khandelwal again and finally it was my destiny, I left Agra College after two months. However by the time I completed my D.Phil. Degree, it was hard to get the permanent position in the same Agra College. Then I realized the words of Dr. Khandelwal. He was very pragmatic person down to earth.

## Committed Leadership

I joined Panjab University in 1972. In those days the Indian Physics Association (IPA) had just been constituted. However most of its physics activities and administration were Mumbai centered - basically in TIFR, BARC and IIT. I was an active member of IPA and Prof. Kushwaha was the Secretary of its Chandigarh Chapter. Over the years, a feeling had started growing that the representation of universities in IPA is minimal and there is no participation of colleges at all. This feeling was going around and during the informal gatherings during a seminar / symposium, this topic was often a subject of discussion. So when Dr Khandelwal started approaching teachers about starting IAPT they welcomed it. Soon, this Indian Association of Physics Teachers (IAPT) was created under the leadership of Dr. Khandelwal and many of my colleagues joined as life member of IAPT. But for sustaining an NGO, the commitment to cause, the zeal to create financial resources and a creditworthy program are most important. Dr Khandelwal had these qualities and IAPT flourished in his committed leadership.

## Concern about Under Graduate Physics

After that I had many occasions to meet Dr. Khandelwal but our relations were the same as in Agra College, very informal and caring. An IAPT convention (1994) was held in Ambala. Prof. Kushwaha had requested few of us to give short talks on Frontiers of Physics. We prepared well with a few transparencies for ten minutes presentation. I started my presentation, Dr. Khandelwal came to me on dais and told silently, please complete in five minutes and request others also to do so. I felt differently, but obeyed his words. Later he told me that the aim of convention is to address under graduate physics; he

was deeply concerned to under graduate physics.

Our view was that physics teaching is comprehensive. The training of subject goes from bottom top and top to bottom. Therefore post graduate and school teaching should also be the parts of IAPT activities.

**Dream of Dr. Khandelwal**

**It is difficult to fulfill the dreams of a founder. But certainly, the dream must be grand.** I personally feel that we must have grown much bigger by now considering the phenomenal increase in the number of colleges, teachers, students, financial resources and communication skills. This needs the vibrant approach, reexamination and review of existing programs, creation of new programs and grooming of young leaders to carry forward IAPT, the most important NGO of the country.

I have profound regard for Dr. Khandelwal as I started my teaching career in Agra College in his supervision and his multiphase contributions to IAPT.

**Satya Prakash**
Former President IAPT
PU Chandigarh

## To our readers

For change of address and non-receipt of the Bulletin, please write (only) to: our New Address :

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REPORT

## ENOPCYC Felicitation Function

**Platform**: Zoom and YouTube livestreaming
**No of participants:** 80 +25 **No of teachers:** 20
**Date**: 12 Oct 2021 **Time**: 6.00pm to 7.40 pm
**Host of the program**: 2018 NAEST topper, Ms Arushi Gupta.
**Organizer**: Ammanni Aveshika, Bangaluru

NANI announced the ENOPCYC& DPK BCC as a year-long celebration. Because of Einstein's Nobel Prize Centenary Year Celebration and DPK BCC 2021, a large number of activities, webinars, quizzes, creative story writing, creating Puzzles, and Hands on activities were organized in various schools and colleges. Three of these activities were competitions and prizes were announced via posters, Whatsapp and emails.

Welcome address and a brief report were given by Coordinator of Ammanni IAPT Anveshika. Dr. Vandana Luthra, Asso. Prof. Gargi College, Delhi and Local Coordinator of Quiz1on Photoelectricity, reported the event, highlighting the performance of the Quiz in an analytical style.

Ms Sheela M B, Secretary Ammanni IAPT Anveshika, elaborated on the Quiz2 on PEE, conducted in association with Maharani Lakshmi Ammanni PU College. HOD Mr. Vadiraj J Manvi was the Local Coordinator.

Dr Anuradha Mukherji, Teacher Developer, The Royal Society of Chemistry, UK and Prof. Sudeshna Mohanty , BPVS college evaluated all the creative stories written by students of class VI to XII.

The report sent by Dr Savitha G, HOD Oxford College was read out in her absence. The events were all managed by students of UG and PG. classes.

President of RC12A, Dr Ananda Kumari enumerated all the webinars conducted across Karnataka for thousands of students.

Ms Nirmala Nagarjuna, HOD Physics, Sri JnanakshiVidyaniketan was exuberant in her narration of how her students have been motivated by puzzles, quizzes and life history of Einstein conducted for them. Prof. Kala N and Sarmistha Sahu have been frequenting this school for very many student-centric activities.

Ms Savitha Manjunath of Sri Kumarans' Children Home, organized a Seminar on Space by Std XII student for the younger lot. It was an activity of a special category and the speaker impacted the other in their course of studies.

Mr Parul Patel had a different story about her interaction and Quiz sessions with her tutorial group. Ms Jyothi Pradeep,VicePrincipal of Bhavan's Adarsh Vidyalaya had volumes of activities, prize winners, and month-long activities. A 10$^{th}$ class student, Advaidh has won several prizes throughout his 15 years of existence! A video of Advaidh making the Picture of Einstein and Photo electricity using Rubic Cubes was shown..

Keynote address by Padmashree H C Verma was a refreshing dialogue with students. A healthy discussion, one-to-one, was satisfying for both students and the organizers.

Vote of thanks marked the end of the memorable event.

**Sarmistha Sahu**
**Coordinator**

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REPORT

## Industrial Visit-cum-Training to Science students and Lab Staff

**Venue**: Marhar Power Control Pvt. Ltd. and Edison Tech Centre Dhuri, District Sangrur
**Date**: 29$^{th}$ Oct., 2021
**Schedule**: 8:30am - 5:30pm
**Resource Persons**: Mr. Kulwant Singh, Mr. Pargat Singh, Mr. Sukhdev Singh
**Sponsored:** DBT Star College Scheme, Govt. of India
**Incharge**: Dr. Vikas Duggal
**No. of Beneficiaries**: 34 (Students) + 3 (Lab Staff) + 3 (Teachers) = 40
**Coordinator**: Dr. Kulwinder Singh Mann

Department of Physics, DAV College Bathinda, under the DBT STAR College scheme organized an industrial visit cum training to Marhar Power Control Pvt. Ltd. and Edison Tech Centre Dhuri, District Sangrur on 29th

October 2021. The one-day trip was organized for students of B.Sc. classes and Lab Staff. The teaching faculty of the Physics and Zoology department, along with Laboratory staff, accompanied the students.

The Marahar Power Control Pvt. Ltd. is a pioneer in devising controlled power units in different types of industrial electric power management related devices. The students learnt various methodologies for designing the devices like cutting, moulding, bending, and insulating with precision. Students got training for the basic safety standards while operating electrical appliances like motors, generators, switch gears, various meters, domestic and industrial power supplies. The trainees were acquainted with the importance of earthing and wearing rubber shoes while operating the electrical appliances. Mr. Pargat Singh, an instructor with 25 years of industrial experience, demonstrated and provided training to the participants.

The students then visited Edison Tech Centre, located inside the industry. This Centre has been established by Mr. Jai Singh (Director) by investing Rs. 2.5crore. It consists of eight sections and various Laboratories. The participants saw various working units of antique units of electrical and electronics appliances, like the first bulb invented by Edison, Gramophone, film projectors, vacuum tube-based devices, radio receivers, a refrigerator that works with a candle (without electricity), etc. The Centre also has an indigenously built treehouse in a green belt consisting of a variety of trees.

Mr. Kulwant Singh organized an interactive session for the participants. Finally, the student representative Ms. Harsimran Kaur and Mr. Bansi Dhar of BSc. III gave their feedback to the Centre. Former Principal of DAV College Jalandhar, Prof. B.K Sharma, Mr. Sukhdev Singh, Dr. Narinder Singh Pandher graced the occasion. Dr. Gurpreet Singh, Head department of physics proposed the vote of thanks.

**K.S. Mann**
**Coordinator**

# 8th IAPT National Student Symposium on Physics

**Venue**: Indian Academy Degree College-Autonomous, Hennur Cross, Bengaluru- 560043

**Organized by:** RC-12 and 12 A, Karnataka and Department of Physics, Indian Academy Degree College –Autonomous, Bengaluru

**Number of participants:** Oral Presentations – 25, Poster Presentations-22

**Other participants**: Out station Students – 13, Local Students – 60

**Volunteers**: B.Sc. and M.Sc., Students of Indian Academy Degree College-Autonomous -16

Inauguration of the 3-day National Student Symposium on Physics was held on 12th November at 9.30 am by lighting the lamp and with invocation by a student of IADCA.

Convener, Dr P Nagaraju, welcomed the guests on the Dias and off the Dias, IAPT fraternity, Invitees, Student participants from across the Country and the gathering at large. He also spoke about the NSSP and its genesis, scope and objectives in brief.

Padmasri A S Kiran Kumar, former Chairman ISRO released the Souvenir & Abstracts of NSSP 2021 along with Prof Ashok M Raichur, Secretary Karnataka State Council for Science and Technology, Dr T Somasekhar, Chairman, Indian Academy Group of Institutions, Dr G Venkatesh, former Chief Co Coordinator of IAPT Examinations and Dr P Nagaraju.

Dr. Venkatesh talked about the life of Prof. D P Khandelwal and his contribution towards Physics, Physics Experiments and Physics education Research in our Country.

The chief guest, Padmasri Kiran Kumar, addressed the gathering at length. He complimented IAPT for conducting the Student Symposium regularly since 2013. He said that the student from across the country meeting at a place is, itself an achievement. This type of National Student Symposium provides an opportunity to exchange their ideas with their counterpart. He described the history of our space programme starting from Vikram Sarabhai. The space programme has improved the quality of human life and it is helping us in various fields such as meteorology, weather forecasting, rain prediction, atmospheric study etc. He also mentioned about Chandrayaan- 1, which explored the presence of water molecules and water on the moon. He explained Mars orbital mission and Astrosat Satellite. The Astrosat is used by Scientists in IIA, IUCAA, RRI, IISc, etc. Today, India is leading in Space and Nuclear Technology due to the efforts of our Scientists. He also mentioned that 100 Crore vaccination of COVID 19 is also an achievement of India. Finally, he said, it is for you (Student participants) to make a change of Science and Technology for good and not for bad things. He concluded by pointing the students, that each one of you have a bigger challenge and therefore you have to take up research in your chosen area and contribute to the Nation in your own way so that India will be at a higher level than any other country.

The guest of honour, Prof Ashok M Raichur, Materials Engineering Dept, IISc and also Secretary, KSCST addressed the gathering by saying that the Conference or Symposium of this kind will have long time effect. Further, the students will have an exposure and can make their friends from across the country. This Symposium is

more of an inter disciplinary nature and definitely help in their career. He also said that, KSCST provides funding for Masters Programme students for their projects and they can utilise this opportunity. He mentioned that in Materials Engineering Department, students are organising the Conference every year and it is being conducted since 30 years. It is a model to other Departments and also to other organisations.

Dr T Somasekhar, in his Presidential remarks mentioned that the students from across the country, who are attending this Symposium are fortunate to listen to the space scientist Sri Kiran Kumar. He expressed his best compliments to IAPT for doing commendable job in the academic field. The students should make use of this opportunity. He also mentioned that KSCST is providing funds for Master programme and that should be utilised by students. Finally, he said that, Indian Academy Education Trust is always open to any kind of academic activity, and we welcome you to collaborate for the Academic Programme.

Prof B S Achutha Co convenor, proposed the Vote of thanks. He mentioned, special thanks to Indian Academy Degree College for providing the entire infrastructure to conduct this National Student Symposium 2021.

After the Inauguration, Prof Vijay A Singh, President IAPT delivered a talk on "The saga of Indian Science Olympiad" in online platform (from Germany). He described how, India participated in Olympiad for the first time in 1998. He gave all the data w r t the Olympiad examinations, participants, accompanied faculty and the medals won by India till today.

On Day 1, the 1st technical Session started with an invited talk on "Quantum communications" by Prof Urbasi Sinha, Raman research Institute (RRI), Bengaluru in offline mode. She described the quantum key distribution (QKD) secure cryptographic keys between distant parties by using single photon to transmit each bit of the key. She gave some live examples to make the topic easy. She answered all the questions raised by the student participants and she also shared her email for any query.

After the invited talk, Oral presentations by the participants started. Prof N Nagaiah, Ex Chairman, Department of Physics, Bangaluru University chaired the Session. 6 (OP1 – OP6) participants presented their papers. He appreciated all the 6 participants and said, he didn't expect that they would present like this.

It is to be noted that, Dr. S K Nataraj, former Professor of Kuvempu University, Dr A G Kulkarni, Retd Director S P planetarium Badora (Gujarat) and Dr S M Khenad Secretary RC 12, all life members(IAPT) were requested to judge the Oral presentations. In the 2nd Session of the Oral presentations, Prof M S Jogad, IAPT EC member, Karnataka, Chaired the Session. 7 (OP7 – OP13) were allotted, except OP7, all presented their papers. In the 3rd Session, Poster presentations were scheduled. Here also 3 Judges were assigned the job of judging the Posters. Dr M K Raghavendra RC 12 A, Dr Shivaram N Patil RC 12 A and Prof B S Achutha RC 12 A. 11 Posters (PP1 – PP11), were allotted and in each poster, the judges took about 10 minutes each, for discussion with the participants. Tea/Snacks were served during the Poster Session. Some participants, who couldn't attend the Symposium in person, sent video clipping of their presentations.

The Cultural programme was arranged by the Students of Indian Academy Degree College- Autonomous for the delegates to relax themselves from the hectic academic schedule. The Student welfare officers and the staff members of IADCA took active part in arranging the Cultural event. After this, the delegates had their dinner.

On Day 2, the 4th Session got started by an invited talk on "The Science of Climate Change" by Prof J Srinivasan, Divecha Centre for Climate Change, IISc, Bengaluru. He said he is very happy to talk to the students face to face, after 2 years. His talk started by showing the photos of the Nobel Laureates in Physics 2021. This year Nobel Prize is shared between the "Physical modelling of Earth's Climate, quantifying variability and reliability predicting global warming" and "for the discovery of the interplay of disorder and fluctuations in physical systems from atomic to planetary scales". He said that climate change is going to be the biggest environmental challenge the world faces in the 21st Century. He also mentioned about the UN Climate change conference held in Glasgow. Thus, he presented the data of the amount of Carbon dioxide for almost 10,000 years. Finally, he answered all the questions of the participants.

After the Invited talk the Oral presentation by the participants started. Dr R Ananda Kumari, President RC 12 A Chaired the Session. The Oral presentation took

place for 6 (OP14 – OP19) participants. All of them presented their papers very well.

In the 5th Session, Poster presentation PP12 – PP22 took place along with Tea Break. The judgement was done by the same judges as in PP1 – PP11. After the Poster Session, Lunch was served.

In the 6th Session, the participants were divided into 4 Batches. These 4 batches visited the Labs in cyclic order; Physics, Chemistry-Biochemistry, Microbiology and Genetics, of Indian Academy Degree College-Autonomous. They also visited the Library of IADCA. The students said that the lab visit was very good. Then there was a Lecture –Demonstration by Chief Mentor Prayoga, Dr H S Nagaraja and his team. They explained that they are trying some innovative experiments in their lab. They demonstrated a few experiments, which were fabricated indigenously. The response of the participants was very good.

In the evening, there was an Online invited talk on " Development of a nano-sensor with single electron spin sensitivity" by Dr Naren Hoovinakatte, Vacuum Architect, Thermo fisher Scientific Eindhoven, The Netherlands. He described the development of a novel nano-sensor, called the SQUID-on tip, which is capable of resolving the magnetic signal from the spin of single electron. He also explained the nano-magnetic imaging capability of these sensors by measurements of vortex dynamics in Super conductors. Some participants asked about the opportunities abroad, he mentioned about the opportunities in Israel and Netherlands.

After the Online lecture, the delegates had their dinner.

On Day 3, the 7th Session started with an invited talk on "Exploring the Universe – Challenges and Opportunities" by Prof Manjit Kaur, Panjab University, Chandigarh in Online mode. She explained different models of an atom including the Standard Atomic model. She said that the main question bothering us is "How do the elementary particles get their mass? She also said, in order to understand the origin of mass of subatomic particles, we have to explore the internal structure of particles at their fundamental constituent level. It requires the highest possible energies to discover new particles. She explained in detail the experiment being carried out at the Large Hadron Collider (LHC) at CERN. She also described the experiments conducted at ATLAS and CMS and India's contribution in these detectors. The Experiments conducted by these two detectors discovered the first and only elementary scalar particle, the Higgs Boson. She was able to inspire many students by her talk and she answered many questions raised by the participants. Thus, the students were fortunate to listen to a Particle Physicist.

After the invited talk, the Oral presentation continued from OP20 - OP 25. Dr V S Shanthahala, Treasurer RC 12 A, Chaired the Session. All the 6 participants presented their papers. She said that, all the presentations were very good.

The Judges declared three prize winners for the Oral presentations and three for Poster presentations.

Soon after the Technical Session, there was a Tea Break and then the formal Valedictory function started. There was an Oral feedback from the participants. The participants said that the Symposium was well organised. They also said that the invited talks were good and some paper presentations (Oral and Poster) were also good. In the written feedback almost all appreciated the arrangements and the hospitality offered by organisers.

The prizes for Oral and Poster presentations are as follows:

Oral Presentations; 1st Prize - Vasudev Mittal, IISER Mohali, 2nd Prize – Tasmiya, Maharani's Cluster University, Bengaluru, and 3rd Prize – Pragathi M S, Maharani's Cluster University, Bengaluru

Poster Presentations: 1st Prize – Naveen B N, PES University, Electronic City, Bengaluru, 2nd Prize – Shashank B, Department of PG Studies in Physics, Vijaynagar College, Hosapet Karnataka and 3rd Prize-Swetha H, Department of PG Studies in Physics, Vijaynagar College, Hosapet Karnataka.

The prizes and the Certificates to the participants were given by the chief guest Dr.Srindhi K Parthasarathi, Principal, Indian Academy Degree College-Autonomous.

The summary of the Symposium was given by Prof K M Raghavendran, Vice President R C 12 A. The chief guest

said that he is very happy to see the participants from across the Country. He spoke about the ancient Indian contribution to Physics by Agastya and others. Finally, Dr P Nagaraju thanked KSCST, KSTA, METAi Technologies, Sri Chaitanya Group of Institutions, Prayoga, Indus International School, C P Junior College, Gulbarga, R K frames of Physics and Indian Academy Education Trust, Indian Academy Degree College students and staff, Media persons, Caterers and the Non-Teaching staff of IADCA and Sathyasri printers.

**P Nagaraju**
**Convenor**
**NSSP 2021**

# IAPT Essay Competition NCEWP -2021 - Results

Topic of the Essay was **"MODERN PHYSICS AND MEDICAL DIAGNOSTICS".**

**Category A: - Students' Result**

| Student Code | Name of the Student/Institution | Total Marks (out of 300) | Rank | Prize details |
|---|---|---|---|---|
| A-30 | Nandan Babu Mishra, Institute for Excellence in Higher Education (IEHE) , Bhopal | **244** | **I** | Rs. 7500/- plus Book and Pen Drive |
| A-47 | Shreya Kalyan VK, SIES College of Arts, Science, Commerce , Sion West, Mumbai | **237** | **II** | Rs. 5000/- plus Book and Pen Drive |
| A-3 | Sudeeksha Batra, Indraprastha World School, PaschimVihar, New Delhi | **237** | **II** | Rs. 5000/- plus Book and Pen Drive |
| A-37 | Bullo Kardo, DeraNatung Government College, Itanagar, Arunachal Pradesh, | **230** | **III** | Rs. 3000/- plus Book and Pen Drive |
| A-38 | SaptadipSaha, RamkrishnaMission Vidyalaya, Viveknagar, Tripura | **230** | **III** | Rs. 3000/- plus Book and Pen Drive |

**Category B:-Teacher's Results**

| Code | Name of the Teacher/Institution | Total Marks (out of 300) | Rank | Prize details |
|---|---|---|---|---|
| B-1 | Venkatesh R,PSNA College,Dindigul, TN | **228** | **I** | Rs. 7500/- plus Book and Pen Drive |
| B-17 | V K Gupta, Government Girls PG College, Ujjain | **227** | **II** | Rs. 5000/- plus Book and Pen Drive |
| B-18 | Sonika Jindal, DAV Public School, Ludhiana | **216** | **III** | Rs. 3000/- plus Book and Pen Drive |
| B-8 | Mihir Pal, Sonamura, KabiNazrulMahavidyalaya ,Sonamura,West Tripura | **216** | **III** | Rs. 3000/- plus Book and Pen Drive |

**S. K. JOSHI**
**Coordinator**

## Congratulations

In the14th International Olympiad on Astronomy & Astrophysics (IOAA) 2021,organised by Colombia, and held in online mode from 14th to 21st November 2021. All five Indian students in the competition won medals: four Gold and one Silver Medals.

Anilesh Bansal - GOLD
Suren GOLD
Arhaan Ahmad GOLD
Chahel Singh GOLD
Dhruv Ahlawat SILVER

The Indian team also bagged the second prize in the Team Competition. In the country-wise medals tally, India was placed in the top position, jointly with Thailand and Russia.

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## Election Result for RC-02

**(Jan. 2022 - Dec. 2024)**

| Post | Name & Address | Life membership No. |
|---|---|---|
| **President** | Dr Jaswinder Singh (*National Awardee*) #17, Ranjit Nagar, Bhadson Road, Patiala | L5439 |
| **Vice President** | Dr Sunil Kumar Wanchoo, Shri Mata Vaishno Devi Univ., Kakryal, Katra(J&K) | L8639 |
| **Secretary** | Dr Rajeev Kumar Sharma, Asstt. Prof. of Physics,PAU, Ludhiana | L5865 |
| **Treasurer** | Dr P.S. Tarsikka, Professor & Head, Punjab Agricultural University, Ludhiana | L3615 |
| **Members** | | |
| 1. | Prof K.S. Mann, DAV Collage, Bibi Wala Road, Bathinda | L6816 |
| 2. | Mrs Sangeeta Sharma, Khalsa College for Women, Civil Lines, Ludhiana | L88855 |
| 3. | Mr Ashish Kapoor, DAV Public School, BRS Nagar, Ludhiana | L6730 |
| 4. | Principal Varinder Singh , Govt. Sen. Sec. School, Kaddon, Dist. Ludhiana | L8640 |
| 5. | Mr. Nikhil Sharma, BCM Arya Model Sr. Sec. School, Sastary Nagar, Ludhiana | L5872 |

**Deepak Chopra**
**Returning Officer**
Mobile: 83602 26538
E-mail: deepakchopra67@gmail.com

# Election Result for RC-03

## (Jan. 2022 - Dec. 2024)

| Post | Name of the IAPT Member | Membership Number | Address | Mobile | Email |
|---|---|---|---|---|---|
| President | Prof. C.Nagaraja Kumar | L3464 | Dept. of Physics, Panjab University, Chandigarh | 98726 44283 | cnkumar@pu.ac.in |
| Vice-President | Prof. O.S.K.Subramanya. Sastri | L3997 | Dept. of Physics, Central University of Himanchal Pradesh, Kangra, Himachal Pradesh | 94180 30901 | sastri.osks@hpcu.ac.in |
| Secretary | Dr. Hemant Kumar | L3469 | Pushpak HIG-3 Phase-2, Housing Board Colony, Nahan,Sirmaur, Himachal Pradesh | 94180 90001 | hknahan@gmail.com |
| Treasurer | Dr. Amit Goyal | L7179 | Dept. of Physics,GGDSD College, Chandigarh | 96463 48964 | amit2iitb@gmail.com |
| EC Member | Dr. Ram Murti | L8041 | Village Samlara P O. Jasana, Tehsil Bangana, Una, Himachal Pradesh | 94182 30891 | rammurtisharma07@gmail.com |

They are hereby declared, duly elected, unopposed, against posts as indicated.
The positions of 04 Executive members, for which no nominations were received, are still vacant.

**A K Taneja**
**Returning Officer**
Phone: 9878066672

**ANNOUNCEMENT**

# Election Result for RC-05

## (Jan. 2022 - Dec. 2024)

Having received only single nomination against each post of RC - 05 (Uttarakhand) and finding all nomination papers valid. I declare the following office bearers of RC - 05 (Uttarakhand) as elected unopposed for the term Jan 2022 to Dec 2024.

1. President: Prof Vipul Rastogi
   IIT Roorkee
2. Vice President: Dr Anand Singh Rana
   SGRR (PG) College Dehradun
3. Secretary: Dr Vijay Kumar
   Graphic Era Hill University Dehradun
4. Treasurer: Shri Kapil Gogia
   SGRR Public School Patel Nagar, Dehradun
5. Members:
   1. Dr Amit Kumar Sharma
      DAV College Dehradun
   2. Dr. Narendra Singh
      ARIES, Nainital
   3. Shri Rohit Sharma
      DAV Public School Dehradun
   4. Dr. Sachin Kumar Srivastava
      IIT Roorkee
   5. Prof. Santosh Dubey
      University of Petroleum & Energy Studies
      Dehradun

**B. P. Tyagi**
**Returning Officer**
Ph: 9837123716
Email: iaptddn@gmail.com

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**ANNOUNCEMENT**

# Election Result for RC-08

## (Jan. 2022 - Dec. 2024)

The nominations of the following IAPT members for the different positions of RC-08, Maharashtra were received and verified from the data available on IAPT website. Since only one valid nomination was received for each post, they are elected unopposed on the post mentioned against their name.

I congratulate all of them.

| Sr. No. Name of the Candidate | Post | Valid/Invalid | Reason for rejection |
|---|---|---|---|
| 1. Dr. Shewale Raghunath Mandaram | President | Valid | – |
| 2. Shaker Muni Avala | Vice President | Valid | – |
| 3. Dr. Smt. Jadhav Lata Devappa | Secretary | Valid | – |
| 4. Patil Shantinath Jingonda | Treasurer | Valid | – |
| 5. Ghan Sriniwas Dattatrayrao | Member | Valid | – |

6. Deshmukh Govind Dinkarrao Member Valid –

**S. Y. Chougule**
**Returning Officer**

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**ANNOUNCEMENT**

## Election Result for RC-08B

**(Jan. 2022 - Dec. 2024)**

The following candidates are declared elected unopposed on posts mentioned, for the term Jan 1, 2022 to Dec 31, 2024

Name of the Post: President
Name of the candidate in full: Dr. Atul K Mody
Life membership number: L3132
Postal Address: B 208 Maruti Paradise, Sector 15 Cbd, Navi Mumbai, Pin: 400614
Contact No. (MOBILE /LANDLINE): 7774030403/ 022 27578571 email: atulmody@gmail.com

Name of the Post: Secretary
Name of the Candidate in Full: Bhole Krishna Girdhar
Life membership number: L2503
Postal Address: 202, Ramkrishna Apt. Mithagar Rd, Mulund East, Mumbai 400081
Contact No. (Landline, Mobile): 022-21634097, 9820551156 email: kgbhole@gmail.com

Name of the Post: Treasurer
Name of the Candidate in Full: Bodhane Shyamala Prajapati
Life Membership No.: L3528
Postal Address: 501, Pravin Smruti, Paranjape Scheme'a'rd No1, Subhash Road, Vileparle East Mumbai 400057
Contact No. (Landline, Mobile): 9869336624, 8652240994 email: spbodhane@gmail.com

**Kalpana Sule**
**Returning Officer**

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**ANNOUNCEMENT**

## Election Result for RC-08C

**(Jan. 2022 - Dec. 2024)**

| S. No. | Position | Name | Membership No. | Name of Institute | Email Id | Contact Number |
|---|---|---|---|---|---|---|
| 1 | President | Prof. Bharat Uddhav Kangude | L5779 | Anantrao Pawar College, Pinrangut, Pune | bharatkangude@gmail.com | 9890106937 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2 | Vice-President | Prof. Varsha Ashutosh Joshi | L8319 | Modern College of Arts, Science & Commerce, Ganeshkhind, Pune | varshajoshi2010@gmail.com | 9850886461 |
| 3 | Secretary | Dr. Sandip Gajanan Kakade | L5546 | Sir Parashurambhau College, Pune | sgksp189@gmail.com | 9561409730 |
| 4 | Treasurer | Dr. Popat Savleram Tambade | L4648 | Ramkrushna More College, Aakurdi, Pune | pstam3@rediffmail.com | 8605529031 |
| 5 | Members (5) | Dr. Ashok Maruti Datir | L2345 | Agasti Arts, Commerce and Dadasaheb Rupwate Science College, Akole | ashokdatir526@gmail.com | 9420945628 |
| | | Dr. Jayshree Abhay Bagwade | L7817 | Vidya Pratishthan's Arts Science & Commerce College, Baramati | jbchimanpure10@gmail.com | 9850562630 |
| | | Dr. Pradip Bhausaheb Shelke | L5795 | Ahmednagar college, Ahmednagar | shelke.pradip@gmail.com | 9422226924 |
| | | Dr. Anil Bhanudas Gite | L8396 | SNJB : Arts, Commerce & Science College, Chandwad | giteanil1@gmail.com | 9850770193 |
| | | Smt. Manisha Sanjay Hawaldar | L3180 | Bharat English School, Shivajinagar, Pune | manisha.hawaldar@gmail.com | 9422174545 |

**U. S. Kakade**
Mobile No.: 9011286723
e-mail Id: uskakade@gmail.com

# Election Result for RC-12A

**(Jan. 2022 - Dec. 2024)**

| Position | Name | LM No. | Affiliation |
|---|---|---|---|
| President | Dr R Ananda Kumari | L 4005 | Former Principal of Shree Siddaganga College of Arts, Science and Commerce, Tumukuru |
| Vice-President | Prof. Shivaram Narayana Patil | L 5269 | Principal, SDC Independent P U college, Kolar |
| Secretary | Dr. Sarmistha Sahu | L 2523 | Professor (Rtd), MLA college, Bangalore |
| Treasurer | Dr. Shanthala V S | L 5320 | Professor, Oxford Engineering College, Bangalore |
| Member | Dr. Venkatesh G | L 3995 | Former Principal of The National college, Gauribidanur, Karnataka |
| Member | Dr. M K Raghavendra | L 4052 | Director, Jnanadhara Educational Services, Bangalore |
| Member | Prof. B S Achutha (Ex-officio) | L 5905 | Faculty of Physics, VVS Sardar Patel P U college, Bangalore |
| Member | Dr Mangalagowri | L7955 | Assistance Professor, University Science college, Tumukuru |
| Member | Dr R S Geetha | L 2490 | Associate Professor (Rtd) Vijaya College, Bangalore |
| Member | Dr B S Srikanta (Ex-officio) | L4847 | Principal, Sindhi first grade college, Bangalore |
| Member | Dr P Nagaraju (Vice President, South zone ) | L2694 | Indian Academy First Grade college, Bangalore |

**M K Raghavendra**
**Returning officer**

**ANNOUNCEMENT**

# Election Result for RC-15

**(Jan. 2022 - Dec. 2024)**

| | |
|---|---|
| Samit Kumar Ray L8591 | President |
| Achintya Pal L6950 | Vice-President |
| | |
| Pradipta Panchadhyayee L3457 | Secretary |
| Lipika Santra L3958 | Treasurer |
| | |
| Sukla Chakrabarti L3803 | Member |
| Jonaki Chowdhuri L6951 | Member |
| Monimala Das L3452 | Member |
| Sanjoy Kumar Pal L5937 | Member |

The vacant posts are expected to be filled up in the first Executive committee meeting of RC-15.

**Mrinal Kanti Chakrabarti**
**Returning Officer**
**IAPT RC-15**

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**ANNOUNCEMENT**

# Election Result for RC-16

**(Jan. 2022 - Dec. 2024)**

The following members of IAPT are hereby declared elected unopposed to RC-16(Odisha) for the term Jan., 2022 to Dec.2024

| **Post** | **Name** | **Membership no.** | **mobile no.** | **email** |
|---|---|---|---|---|
| **President** | Prof. Shree Mishra | L 4292 | 98610 55808 | m_shree_in@yahoo.com |
| **Vice-President** | Prof. Pravati Misra | L 0411 | 94372 02665 | pravati.misra@gmail.com |
| **Secretary** | Prof. Rita Paikaray | L 3694 | 94371 47150 | r_paikaray@rediffmail.com |
| **Jt. Secretary** | Dr Kishore Chandra Dash | L 2010 | 94373 43874 | kesidash@gmail.com ] |
| **Treasurer** | Dr Manjusha Jena | L 5542 | 98612 12497 | manjusa2@rediffmail.com ] |

**Executive members-**

| | | | | |
|---|---|---|---|---|
| 1) | Prof. L. P. Singh | L 3376 | 99376 24505 | lambodar_uu@yahoo.co.in] |
| 2) | Dr Sanjay Kumar Suar | L 3440 | 99372 20263 | sanjaysuar@gmail.com |

| | | | | |
|---|---|---|---|---|
| 3) | Dr Sunil Ranjan Biswal | L 2564 | 93370 9753 | sunilranjan_biswal@yahoo.com |
| 4) | Mrs Rajashree Mohapatra | L 6778 | 99386 42030 | rajashreemohapatra@yahoo.com |
| 5) | Sri Mihir Ranjan Saran | L 4289 | 94372 30053 | mihir.saran@gmail.com |

**L. P. Singh (L 3376)**
RO Mob- 99376 24505
Email- lambodar_uu@yahoo.co.in

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**ANNOUNCEMENT**

## Election Result for RC-07

**(Jan. 2022 - Dec. 2024)**

| Sr. No. | Post/ Designation | Name | Address and mail id |
|---|---|---|---|
| 1 | President | Prof. P. C. Vinodkumar L2284 | Head, Department of Physics, Sardar Patel University, Vallabh Vidyanagar – 388120 p.c.vinodkumar@gmail.com |
| 2 | Vice President | Dr. J. A. Bhalodia L2947 | Department of Physics, Saurashtra University, Rajkot-360005 jabrajkot@rediffmail.com |
| 3. | Secretary | Prin. Dr.Pruthul R. Desai L4160 | Sir P. T. Sarvajanik College of Science, Surat-395001 pruthuldesai@gmail.com |
| 4. | Treasurer | Dr. Punit Suthar L7055 | Department of Physics, C U Shah Science College, Ahmedabad-380014 punitsuthar@gmail.com |
| 5 | Member | Prof. P. N. Gajjar L5142 | Head, Department of Physics, School of Sciences, Gujarat University, Ahmedabad-380009 pngajjar@rediffmail.com |
| 6 | Member | Prof. N. K. Bhatt L5083 | Head, Department of Physics, MKBU, Bhavnagar-364001 nkb@mkbhavuni.edu.in |

| | | | |
|---|---|---|---|
| 7 | Member | Dr. Darsan Vyas<br>L4356 | Department of Physics, HNGU,<br>Patan-384265<br>vyasdg@yahoo.com |
| 8 | Member | Dr. Anil Gor<br>L8356 | Shri R RLalan College, Bhuj, Kutchh- 370001<br>anilgor@ymail.com |
| 9 | Member | Dr. Ghanshyam R Patel,<br>L6316 | Government Science College, Gandhinagar-382006<br>grpalp94@gmail.com |

**Kiritsinh B. Zankat**
**Returning officer**

**Rajshree B. Jotania**
**Secretary**

**ANNOUNCEMENT**

# Election Result for the RC-01

**(JAN 2022-DEC 2024)**

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| 1 | President | Dr. Seema Vats | L5510 | Assoc. Professor of Physics, MLN College, University of Delhi, Delhi<br>drseemavats@gmail.com |
| 2 | Vice President | Shri Surjan Singh | L8625 | Principal, ITBP Public School, Sector 16B, Dwarka, New Delhi 110078<br>surjanmathuria@gmail.com |
| 3 | Secretary | Dr. Yogesh Kumar | L8471 | Asstt. Professor of Physics, Deshbandhu College, University of Delhi, Kalkaji, New Delhi-110019<br>yogesh.du81gmail.com<br>ykumar@db.du.ac.in |
| 4 | Treasurer | Dr. S. K. Singhal | L7285 | HOD Science, Amity International School, Mayur Vihar, New Delhi-110091<br>singhal.s.k@yahoo.co.in |
| 5 | Member | Dr. Poonam Jain | L8470 | Asstt. Professor of Physics, Sri Aurobindo College, University of Delhi, Malviya Nagar, New Delhi-110017<br>poonam.jn1@gmail.com<br>pjain_phy@aurobindo.du.ac.in |
| 6. | Member | Dr.H.K.Sahjwani | L0609 | Retd Prof. S.D.Cllege, Panipat Haryana<br>harisahjwani@gmail.com |
| 7. | Member | Dr. Ajay Garg | L7457 | Head of Physics Dept.<br>Arya P.G. College, Panipat, Haryana<br>ajay2471@gmail.com |
| 8. | Member | Dr. Manoj Kaushik | L2886 | Lecturer in Physics<br>SCERT, Opposite Panchayat Bhawan, Sohna Road, Gurugram, Haryana<br>mamoj_kaushik6171@yahoo.com |
| 9. | Member | Vikas Mittal | L7156 | Lecturer in Physics<br>Ryan International School, Faridabad, Haryana<br>mittalvikalp@yahoo.com |

**R.S.Dass**
**Returning Officer**

# The Story of Cosmology through Postal Stamps- 09

## MEDIVAL ASTRONOMY

***LATIN IMAGO MUNDI***

Astronomical research had not experienced any significant development in the era of the Roman Empire. With the rise of Christianity, Church saw no advantage for Christian in dealing with astronomy. Most of work that time was only of translation and commentary, but in 12th and 13th century attempt to represent accurate image system of universe was resumed


***A souvenir sheet of 6 stamps***

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**Symbols of planets started to appear in medieval text**


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