



# **BHOUTHIKA JYOTHI**

**DEPARTMENT OF PHYSICS  
ST. STEPHEN'S COLLEGE  
UZHAVOOR**

## Faculty Members



Sitting: (L -> R) 1. Prof. James Kurian 2. Prof. K.L. Thomas 3. Prof. Cherian Thomas (H.O. D.) 4. Prof. John Zachariah  
5. Prof. Shaji Sebastian

Standing: (L -> R) 1. Prof. Lally K. Cyriac 2. Prof. Reenamma Cyriac Mathew 3. Prof. K.J. Sebastian

## **Final Year MSc ( 2008 - 2010)**



## **Final Year B.Sc ( 2007 - 2010)**



# BOUTHIKA JYOTHI

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Department Of Physics

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*Cover picture: Prof. K.M. Mathew Astroview centre*

## From the Chief Editor's Desk

This edition of the 'Bhouthikajyothi' is being published as a Ruby jubilee special. We have been celebrating the Ruby Jubilee of our Department since 2007 as the 40<sup>th</sup> B.Sc. Physics batch of students are studying here in this period. With the publication of this 'Jyothi' our Jubilee celebrations come to a close, but its memories should last. Ruby Jubilee is in fact the start of the last lap towards Golden Jubilee. During the preceding Jubilee years we had a lot of activities in our department.



We owe to the family of Prof. K.M.Mathew for establishing our Astroview Centre. It is an apt monument of our Jubilee, as Prof. K.M.Mathew was the first Head of The Physics Department. We thought of an Astroview Centre as the jubilee monument because 2009 was the Inter National Year of Astronomy.

The gathering of The Physics Alumni on 16<sup>th</sup> February, was a great inspiration to the Department because the day proved beyond doubt the love and concern of our alumni towards their alma-mater. Many of them volunteered to contribute generously for the jubilee projects.

The jubilee projects in the anvil include smart class rooms for M.Sc., renovation of computer lab and beautification of the faculty room. Hope these could be accomplished before the next academic year.

In these forty years our students could bag many achievements in quizzes, sports, arts, power point presentations, gate and net; but a rank at the university level is yet remaining as a dream. Let us hope to fulfill the dream at the earliest.

Since the national Science Day, 28<sup>th</sup> February is a Sunday, this year we publish the 'Bhouthikajyothi' on 1st March.

Finally, a word of personal affairs: As per the present rules, I am to step down from this institution on 31<sup>st</sup> of this month. Let me place on record my gratitude and obligation to the management, colleagues of our department and my beloved students for nurturing me to the what I am now.

With all wishes,

*Cherian Thomas*

*Uzhavoor*

*1<sup>st</sup> March 2010*



## ARCHEPARCHY OF KOTTAYAM

CATHOLIC METROPOLITAN'S HOUSE

P.B. NO. 71, KOTTAYAM- 686 001

KERALA, INDIA.

### Message

I am delighted to learn that the Physics Department of St. Stephen's College, Uzhavoor is publishing a souvenir in connection with its Ruby Jubilee celebrations. My hearty congratulations to all who have contributed towards the publication of the same.

As a former student, it is with great pleasure that I join you in celebrating the Ruby Jubilee of the Physics Department of St. Stephen's College, Uzhavoor. I am sure that the appreciable service rendered by the Department of physics of our college imparted excellent academic and human formation to many young people of Uzhavoor and surroundings. It has been a blessing of the Almighty for many youth from our Archdiocese and students from all over kerala to get a professional qualification.

I take this opportunity to recall the dedicated service of the teaching and non - teaching staff who, throughout these years, have contributed wholeheartedly to the growth and excellence of this department. I wish that the Ruby Jubilee Celebrations be an occasion for all of us to imbibe the spirit of the founders and commit ourselves to the further development of the institute.

Invoking God's belssings upon you all.

*Mar Mathew Moolakkatt*

Mar Mathew Moolakkatt  
Metropolitan Archbishop of Kottayam





### Message from the Manager

With profound gratitude, may I congratulate the head of the department, teachers and students of the department of physics which is celebrating the Ruby Jubilee. Opening of the Prof. K.M. Mathew astroview centre shows their dedication and commitment towards promoting scientific activities in the campus. The department is very keen in developing globally competent and socially committed students. I wish them all success.

Fr. Alex Akkaparambil,

Manager,  
St. Stephen's College,  
Uzhavoor.



### Message from the Principal

It is a pleasure to know that the Post graduate department of Physics is celebrating the Ruby Jubilee. The department of Physics is one among the departments of this college with eleven faculty members. The department aims at achieving academic excellence by imparting current scientific knowledge, exposing the learners to latest development in science and technology, encouraging their creative skills and making them aware of the social needs. This will surely lead to the integral development of the Physics students.

I also remember with gratitude the co operation of Prof. Cherian Thomas and his team in all the curricular and co - curricular activities of the college.

I congratulate Prof. Cherian Thomas the Head of the Department and other faculty members and extend my co - operation and best wishes in all their endeavors.

Prof. Babu Thomas  
Principal

# OUR RETIRED FACULTY



### **Prof. P.M. ALEXANDER**

Date of Entry                    08-06-1964

Date of Retirement        31-05-1996

Head of the Department - (1992- '96)

#### ADDRESS

Puthenpurayil (h)  
Kizhapparayar  
Bharananganam – 686578  
Phone: 04822-236326  
E-mail: alex41@eth.net



### **Prof. K.M. MATHEW**

Date of Entry                    22 - 06-1968

Date of Retirement        31- 03 -1996

Head of the Department - (1968 - '92)

Principal - (1992 - '96)

Passed Away on 1 Dec, 2007

### **Prof. K.K. JOSE**

Date of Entry                    08-06-1970

Resigned from service 01-11-1978

Presently Working in U.S.A

### **Prof. Fr. LUKE PUTHIYAKUNNAL**



Date of Entry                    July 1968

Date of Retirement        March 1992

Principal - (1983 - '92)

#### ADDRESS

Puthiyakunna (H)  
Uzhavoor P.O  
686634  
Phone: 254219 (Contact Number)

**Prof. V. J. JOSEPH**

Date of Entry            06-07-1970

Date of Retirement    31-03-1997

Head of the Department - (1996 - '97)

## ADDRESS

Vattadikunnel H

Monippally P.O

Kottayam

**Prof.C. M. MARYKUTTY**

Date of Entry            29-09-1975

Retired as Selection Grade Lecturer from BCM college, Kottayam

**Prof. C. U. MARY**

Date of Entry            29-09-1976

Date of Retirement    31-05-2007

Head of the Department - (1997 - 2007)

## ADDRESS

Karukapparambil H

Uzhavoor P.O

686634

Phone: 240355

Presently in U.S.A

**Prof. CELINE K. JOSEPH**

Date of Entry            23-10-1978

Passed Away on 15 November 1996

**Prof. PETER ABRAHAM**



Date of Entry 22-10-1981

Working as The Director, Mangalore Airport

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**Prof. JOHNY M. C.**



Date of Entry 24-11-1981

Presently Working in U.S.A

---

**Prof. JAMES MATHEW**

Date of Entry 25-10-1982

Presently Working in U.S.A

---

**Prof. JOSE KURUVILA**

Date of Entry 28-08-1984

Presently Working in U.S.A

---

**Prof. JERARD THOMAS**

Date of Entry 10-06-1986

Presently Working as Manager, Karur Vyshya Bank

# 40 YEARS OF EXCELLENCE

Fr. Luke Puthiyakunnel.

*[Fr. Luke Puthiyakunnel was a lecturer of the dept. of physics from 1968 - 83. He served as the principal of the college from 1983 - 93. In the article he recalls the development of the college and the physics department during the last 40 years.]*

“A mustard seed though very small when fully grown becomes one of the biggest trees.(Mt. 13: 31 - 32”.

When we celebrate the ruby jubilee of the department of Physics, St. Stephen’s College, Uzhavoor, the above cited biblical quotation becomes true. In 1964, when St. Stephen’s was started, it had not even a holding with a building. The college had its humble beginning in St. Joana’s convent U.P. school with late Fr. Peter Uralil at the helm of affairs and Prof. P.M. Alexander, now retired, in charge of the physics department. Following year, the college was shifted to the present site with very little facilities. Physics was a compulsory subject for first and second groups. Pre-degree physics laboratory was set up with the bare minimum. This state of affairs continued until 1968 when the college was upgraded with degree courses in Mathematics, Physics, Zoology, English and Economics. Late Prof. K.M. Mathew and I joined the department of Physics and the former was made the head of the department. A Full fledged B.Sc. Physics lab was set up under the supervision of Profs. K.M. Mathew and P.M. Alexander . Later Prof. K.K. Jose and Prof. V.J. Joseph also joined the staff. After a few years of service the former left for the United States. There was great team spirit among the staff members which as very exemplary and cosequently the department was one of the prestigious departments of the college. Later on more teachers joined the department as more pre-degree batches were added. All the staff membres were very earnest to keep up the tradition and produced good results in pre-degree and degree examinations. When chemistry main was introduced physics was a subsidiary subject. As time passed on there was strong move to introduce P.G. courses in the college, Physics had the first claim. This long cherished dream was materialised in the year 1995. When I retired from the Principalship, Prof. K.M. Mathew was made Principal and Prof. P.M. Alexander became H.O.D. During his period the department could make giant strides in the developmental side. He was followed by Prof. V.J. Joseph and Prof. C.U. Mary, the latter working in the united states afer retirement. After her turn Prof. Cherian Thomas took up the charge of H.O.D. and he left no stones unturned in modernizing the department and at present the department is second to none in excellence and quality.

Ruby jubilee of the department was celebrated in a large scale in the presence of H.G. Mar. Mathew Moolekkatt, Arch Bishop of Kottayam and former student of the department. Then Prof. K.M. Mathew Astroview centre was inagurated with the installation of a large telescope in memory of late Prof. K.M. Mathew. My congratulations go to all the members of the department of physics who strain every nerve for making the department ‘A Ruby’ of the college. I wish and pray that the department may be made a research centre of excellence in the near future.



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## Prof. K.M. Mathew Astroview Centre

John Zachariah

“Twinkle Twinkle little Star,  
How I Wonder What You Are,  
Up Above the World So High,  
Like A Diamond in the Sky.”

All of us have heard this Rhyme in our schooling age. However, few of us have the chance to renew our wonder of the twinkling diamonds. Some of us have visited a planetarium. Only a very few are lucky to get a chance to peep through a telescope. Therefore many of us do not realise that learning about stars and identifying them in the sky is a real fun, a real thrill!!

Hans Lippershey, a young scientist belonging to Netherlands invented telescope in 1608. Although Hans was not awarded the patent, Galileo heard of this story and decided to point the telescope towards the heavens. In 1609, he first turned his telescope to the night sky and made astonishing discoveries : mountains and craters on the moon, a plethora of stars invisible to the naked eye and moons around the Jupiter. Astronomical observations reveal how planets and stars are formed, how galaxies assemble and evolve, and what the structure and shape of our universe actually are. In the same year Johannes Kepler published his work “Astronomia nova” in which he described the fundamental laws of planetary motions.

2009 coincides with the 400<sup>th</sup> anniversary of the first recorded astronomical observation with a telescope by Galileo and the publication of Johannes Kepler’s Astronomia nova. The 62<sup>nd</sup> UN general assembly declared 2009 as the International Year of Astronomy: we are really proud of opening a sky watching centre in the college during the celebration of astronomy.

Prof. K.M. Mathew Astroview Centre is a small scale observatory installed in our college, attached to the Department of Physics. The astroview centre is a memorial of Prof.K.M. Mathew who was the founder Head of The Department of Physics and former Principal of the college. The centre was sponsored by his family. Astroview centre facilitates the teachers and students of our college and neighbouring educational institutions and the public to observe the sky and enjoy the beauty of it.

The Astroview Centre was inaugurated by H.E. Arch Bishop Mar Mathew Moolakkattu an alumnus of the Department of Physics and a student of Prof. K.M. Mathew on 16/01/2010. The Astroview Centre stands as a monument of the Ruby Jubilee of the Department of Physics and the International year of Astronomy..

There are reflector type and refractor type of astronomical telescopes. The quality of the image formed depends mainly on the aperture of the reflecting concave mirror or refracting convex lens used in the telescope. Larger the aperture, greater the quantity of light from the object collected by the concave mirror or convex lens and focussed, leading to greater quality of image. Conqueror I, a reflector type telescope with a concave mirror 8 inches in diameter manufactured by Sharp Vison Scientific company, New Delhi is utilised in the Astroview centre.

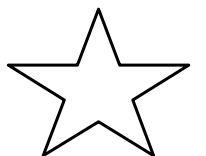
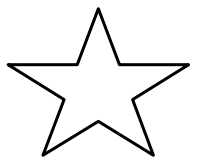
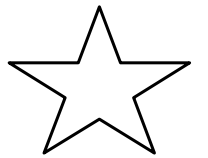
With the telescope in our possession we can explore the depths of universe. Double stars and clusters, variable stars and nebulae all lie within our reach. The sky is full of fascinating things sufficient for a life times entertainment. Starting with the star groups or constellations, we can identify many planets at different times of the year, dozens of features on the surface of the moon. With a telescope we may spot numerous double stars, clusters, nebulae, the moons of Jupiter and phases of Venus. As we watch the sky, night after night we start identifying which stars to be expected in summer, which constellations will decorate winter skies, which planets shine in the morning sky and what others remain in the west after setting of the sun.

Gradually as we build up a physical conception of the shifting position of different objects in the night sky, we start perceiving the actual motion of our earth, its rotation on an inclined axis and its orbit around the sun in a plane identified in the sky by the zodiac belt. Going still deeper we concentrate on the distances and distribution of stars and conceive the shape of our galaxy - the Milky way. And soon we locate other galaxies and come right to the frontiers of modern astronomy and start speculating on the theory of expanding universe.



The Joy  
of  
Sky  
Watching





# International Year of Astronomy

The **International Year of Astronomy (IYA2009)** was a year-long celebration of astronomy, which took place in 2009 to coincide with the 400th anniversary of the first recorded astronomical observations with a telescope by Galileo Galilei and the publication of Johannes Kepler's *Astronomia nova* in the 17th century. The Year was declared by the 62nd General Assembly of the United Nations. A global scheme, laid out by the International Astronomical Union (IAU), has also been endorsed by UNESCO—the UN body responsible for Educational, Scientific and Cultural matters.

The IAU coordinated the activities of the International Year of Astronomy in 2009. This initiative was an opportunity for the people to gain a deeper insight into astronomy's role in enriching all human cultures. Moreover, it served as a platform for informing the public about the latest astronomical discoveries while emphasizing the essential role of astronomy in science education.

In 1609, Galileo Galilei first turned one of his telescopes to the night sky and made astounding discoveries that changed mankind's conception of the world forever: mountains and craters on the Moon, a plethora of stars invisible to the naked eye, and moons around Jupiter. In the same year, Johannes Kepler published his work *Astronomia nova*—in which he described the fundamental laws of planetary motions.

On 25th September 1608, Hans Lippershey, a young man from Middleburg, invented the telescope. Galileo heard of this discovery and decided to use the "Dutch perspective glass" and point it towards the heavens.

## Vision

The vision of IYA2009 was to help people rediscover their place in the Universe through the sky, and thereby engage a personal sense of wonder and discovery. IYA2009 activities took place locally, nationally, regionally and internationally. National Nodes were formed in each country to prepare activities for 2009. These nodes established collaborations between professional and amateur astronomers, science centres and science communicators. More than 100 countries were involved, and well over 140 participated eventually. To help coordinate this huge global programme and to provide an important resource for the participating countries, the IAU established a central Secretariat and an IYA2009 website as the principal IYA2009 resource for public, professionals and media alike.

## Aims

Astronomy, the oldest science in history, has played an important role in most, if not all, cultures over the ages. The International Year of Astronomy 2009 (IYA2009) is intended to be a global celebration of astronomy and its contributions to society and culture, stimulating worldwide interest not only in astronomy, but in science in general, with a particular slant towards young people.

that unites amateur and professional astronomers in an international and multicultural family that works together to find answers to some of the most fundamental questions that humankind has ever asked. The aim of the Year is to stimulate worldwide interest in astronomy and science under the central theme “**The Universe, Yours to Discover**”.

## Goals

The major goals of IYA2009 were to:

1. Increase scientific awareness;
2. Promote widespread access to new knowledge and observing experiences;
3. Empower astronomical communities in developing countries;
4. Support and improve formal and informal science education;
5. Provide a modern image of science and scientists;
6. Facilitate new networks and strengthen existing ones;
7. Improve the gender-balanced representation of scientists at all levels and promote greater involvement by underrepresented minorities in scientific and engineering careers;
8. Facilitate the preservation and protection of the world’s cultural and natural heritage of dark skies in places such as urban oases, national parks and astronomical sites.

As part of the scheme, IYA2009 helped less well-established organizations from the developing world to become involved with larger organizations and deliver their contributions, linked via a huge global network. This initiative also aims at reaching economically disadvantaged children across the globe and enhance their understanding of the world.

## STARS

- ❑ Stars are being born and dying all over the universe. By looking at stars in different stages of their life, astronomers have worked out their life stories.
- ❑ Medium sized stars last for about 10 billion years. Small stars may last for 200 billion years.
- ❑ Big stars have short fierce lives of 10 million years.
- ❑ Stars start life in clouds of gas and dust called nebulae.
- ❑ Inside nebulae, gravity creates dark clumps called dark nebula, each clump containing the seeds of a family of stars.
- ❑ As gravity squeezes the clumps in dark nebulae, they become hot.
- ❑ In a medium sized star like our sun, the heat of burning hydrogen pushes gas out as fiercely as gravity pulls inwards, and the star become stable.
- ❑ Medium sized stars burns steadily until all of their hydrogen fuel is used up.

## LOVING AND LEAVING HOD

Prof. John Zachariah

Prof. Cherian Thomas has been appointed H.O.D. of the Physics w.e.f. 1<sup>st</sup> June 2007. Being a devoted teacher he earned the reverence of generations of students and their parents. From the very date of appointment as a faculty in the department of physics he discharged his duties sincerely for 32 years.

He was born on 31<sup>st</sup> march 1955 at Chathankary in Thiruvalla. After schooling at the native village he joined Mar Thoma College Thiruvalla for pre - degree course. He has done his degree course in Physics in the same college. Being studious, obedient and humble he got the love and care of his teachers and classmates. After the degree course he joined S.B. College Changanacherry for M.Sc physics. S.B. College was proud of Sri. Cherian Thomas that he secured 3<sup>rd</sup> rank in M.Sc Physics examination conducted by the Kerala University in 1978. This rank was a gift presented by Him to the teacher parents of Cherian Thomas for their humble and godly life.

Sooner rather than later Sri. Cherian Thomas got appointment as a lecturer in Physics in St. Stephen's College on 02/01/1978. Later he took his M.Phil. degree from CUSAT in 1989. Since the appointment in 1978 Sri. Cherian Thomas held many important positions in the college and the university, viz; Arts Club director, Staff Secretary, AKPCTA secretary, Returning officer, Member of Board of Studies (MGU), Board of chairman of M,Sc.(previous) etc. Also he served as acting Principal of the college while the Principal was on leave for 4 months. In all the positions, he could present very successful performance.

The service of Prof. Cherian Thomas is not confined to the College alone, but extended to the Churches also. He is serving as Sunday school teacher for more than 32 years. He is the secretary of Orthodox Vacation Bible School for the last 12 years.

In 1986 Prof. Cherian Thomas put the nuptial knot on Dr. Susan Varghese, Department of Chemistry, C.M.S. College Kottayam. Their daughter Ms. Angel secured first rank in M.Sc. Physics exam conducted by SPAP, M.G. University in 2004. Now she is working as Research Assistant in CUSAT. She is married to Mr. Gino Varghese Chacko and they have a little son Jeramy. The elder son Mr. Christy after his M.Sc. in physics is presently engaged in research work in nano technology in National University Singapore. Even though Prof. Cherian Thomas is getting ready for retirement, his home at Chavituvaray, Kottayam is still lively with the cacophony (kalapila) of his little Ben doing his Std III in Baker Vidhya Peeth, Kottayam.

Being a devoted Christian Prof. Cherian Thomas is very strict observing each and every Lent which are recognized by the Church. On Saturdays and holidays he is busy with biblical talks and quiz programs in different parishes across the state.

We pray to God Almighty to shower him with blessings. We wish him a very graceful future.

**BUDDING SCIENTIST****SYNTHESIS & CHARACTERISATION OF COBALT FERRITE & PREPARATION OF FERROFLUID CONTAINING  $\text{CoFe}_2\text{O}_4$  NANO-PARTICLES**

Priyanka B.

[Priyanka B. was an M.Sc. student of our college during 2007 - 09 hailing from Kozhikode. She was an enthusiastic student of our college. This is the work she had done as a project for her M.Sc. under the guidance of Dr. Mohammed of Maharajas College, Ernakulam.]

**I INTRODUCTION****A) FERRITES**

Ferrites are ferri-magnets. The first magnetic material known to man was magnetite  $\text{Fe}_3\text{O}_4$ , which is known as ferrous ferrite. Ferrites are magnetic oxides, belonging to the class of magnetic dielectrics because of their high permeability, high resistivity, and low losses of hysteresis. They are widely used in high frequency applications because an ac field does not induce undesirable eddy currents in an insulating material. This characteristic is very useful in magnetic materials for communication and information devices. They can be easily prepared using ceramic processing technique.

Ferrites are usually non-conductive ferri-magnetic ceramic compounds derived from iron oxides such as hematite ( $\text{Fe}_2\text{O}_3$ ) or magnetite ( $\text{Fe}_3\text{O}_4$ ) as well as oxides of other metals. When a divalent ferrous ion is replaced by another divalent metal such as Mn, Co, Ni, Cu, Mg, Zn, or Cd, one obtains a ferrite of general composition  $\text{M}^{2+}\text{Fe}_2^{3+}\text{O}_4$ , where  $\text{M}^{2+}$  is the divalent metal ion. There are mixed ferrites also, which is obtained by replacing  $\text{Fe}^{2+}$  ion with a mixture of ions.

Ferrites are, like most other ceramics, hard and brittle. In terms of the magnetic properties, ferrites are often classified as “soft” and “hard” which refers to their low or high coercivity of their magnetism, respectively. They can be generally classified into 3 categories based on their crystal structure as.

- a) Spinel (Cubic structure eg: Cobalt ferrite, Nickel ferrite...)
- b) Garnet (Cubic structure)
- c) Magnetoplumbite (hexagonal structure eg: Barium ferrite, Strontium ferrite)

**B) NANO MATERIALS**

Nano-materials are materials possessing grain size of the order of a billionth of a meter. They manifest extremely fascinating and useful properties, which can be exploited for a variety of structural and non-structural applications.

Nano-materials are exceptionally strong, hard, ductile at high temperatures, wear-resistant erosion-resistant, corrosion-resistant, and chemically very active. Materials consisting of particles with diameter less than 100 nanometer have attracted a great deal of recent research attention; Owing to their ultra fineness in size and very high surface area, these particles possess dramatic changes in physical and chemical properties as compared to their bulk counter parts which makes them ideal template to study the physics at the nano-level from the fundamental point of view in addition to the vast application potential in versatile fields.

Nano-particles behave quite different from their coarser-grained counter parts of the same composition due to the high surface to volume ratio. The more loosely bound surface atoms constitute

a significant fraction of the sample and their properties influence its behavior. For example the melting point of gold is dramatically reduced when the particle diameters are below 5 nm. Improvements can also be made in the mechanical and magnetic properties of materials by varying the particle size.

Nano-particles display novel physical properties resulting from surface or quantum size effects. The enhancement of magnetization per atom and decrease in the blocking temperature from the bulk values is induced by the controlled size in a super paramagnetic regime.

The term “Nano-structured Materials” was introduced into literature soon after the conference on “Materials with Ultra fine Microstructures” held in Atlantic City in the year 1990. One of the main features of nano-materials is the fact that their microscopic structure affects the macroscopic properties, giving rise to a wide variety of new phenomenon.

Owing to the extremely small dimensions of nano-structured materials, a major portion of the atoms lie at the grain boundaries, this in turn is responsible for superior magnetic, dielectric and mechanical properties in these materials compared to their conventional coarse sized grains. The reduced dimension of nano-crystalline materials can lead to novel properties compared to their conventional counterparts. Materials in the nano-level possess altogether different magnetic properties.

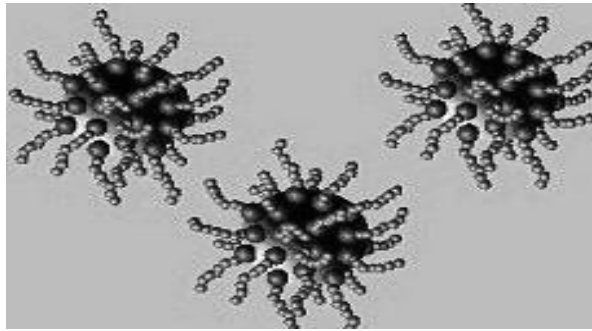
The magnetic properties are substantially changed when the size becomes very small. Below a certain size, the magnetic materials are single domain and they exhibit superparamagnetism. The superparamagnetism of materials are determined by the magnetic anisotropy and the volume factor, which comes from electron spin-orbital angular momentum, coupling at lattice sites in the crystal structure. These materials have potential application in diverse areas such as information storage, color imaging, ferro-fluids and magnetic refrigeration.

The magnetic behavior of the particles at the surface differs from that corresponding to the core, because of the distinct atomic coordination, compositional gradients and concentration and nature of the defects present in both regions. Thus, whereas the core usually displays a spin arrangement similar to that of the bulk material, a much higher magnetic disorder is present in the surface, giving rise to magnetic behaviors which cover from that of non-collinear surface to that of a spin glass like behavior.

New synthesis routes to produce nano-materials and the emergence of new measurement/analytical techniques have resulted in the discovery of exotic and novel nano-materials. Magnetic fine particles have been successfully prepared by numerous chemical routes such as self-assembling, gas condensation, reverse micelle synthesis, co-precipitation, thermal decomposition, sol-gel and aero-gel process. High energy ball milling is also used as an alternate route to obtain novel materials through solid state reactions. Among these methods sol-gel process allows good control of the properties of ceramic materials. The advantage of this method includes processing at low temperature, mixing at the molecular level and fabrication of novel materials for various devices.

A particle below a critical size displays single domain characteristic and exhibit superparamagnetism. A brief treatment on the considerations of superparamagnetism is reproduced here for continuity.

### C) FERRO FLUIDS



Ferro-fluids are stable suspensions of colloidal ferromagnetic particles in suitable non-magnetic carrier fluids. Ferro-fluids, also called magneto fluids, are colloids consisting typically of 10-nm magnetic particles coated with a surfactant to prevent aggregation, and suspended in a liquid such as transformer oil or kerosene. The nano-particles are single-domain magnets, and in zero magnetic fields, at any instant of time, the magnetization vector of each particle is randomly oriented so the liquid has a zero net magnetization. When a DC magnetic field is applied, the magnetization of the individual nano-particle all align with the direction of the field, and the fluid acquires a net magnetization. Typically ferro-fluids employ nano-particles of magnetite,  $\text{Fe}_3\text{O}_4$ . Ferro-fluids are soft magnetic materials that are super paramagnetic. Interestingly, suspensions of magnetic particles in fluids have been used since 1940's in magnetic clutches, but the particles were larger, having micrometer dimensions. Application of a DC magnetic field to this fluid causes the fluid to congeal into a solid mass, and in the magnetic state is not a liquid. A prerequisite for ferro-fluids is that the magnetic particles have nanometer sizes. Ferro-fluids have a number of interesting properties, such as magnetic-field-dependent anisotropic optical properties.

Analogous properties are observed in liquid crystals, which consist of long molecules having large electric dipole moments, which can be oriented by the application of an electric field in the fluid phase. Electric-field-modulated birefringence or double refraction of liquid crystals is widely used in optical devices, such as liquid crystal displays in digital watches, and screens of portable computers. This suggests a potential application of ferro-fluids employing magnetic field induced birefringence. To observe the behavior, the ferro-fluids is sealed in a glass cell having a thickness of several micrometers.

When a DC magnetic field is applied parallel to the surface and the film is examined by an optical microscope, it is found that some of the magnetic particles in the fluid agglomerate to form needle like chains parallel to the direction of the magnetic field. As the magnetic field increases more particles join the chains, and the chains become broader and longer. The separation between the chains also decreases. It is found that initially at low fields the ends of the chains are randomly distributed in the plane of the fluid. As the field increases a critical field is reached where the chain ends become ordered in a 2D hexagonal array. This behavior is analogous the formation of the vortex lattice in type2 superconductors. The formation of chains in the ferro-fluids film when a DC magnetic field is applied makes the fluid optically anisotropic. When a linearly polarized light is incident on a magneto fluid film to which a DC magnetic field is applied, the light emerging from the other side of the film is elliptically polarized. Elliptically polarized light occurs when the E and H vibrations around the direction of propagation are confined to 2 mutually perpendicular planes, and the vibrations in each plane are out of phase. This is called the *Cotton-Mouton effect*.

Ferro-fluids can also form magnetic field tunable diffraction gratings. Diffraction is the result of interference of two or more light waves of the same wavelength traveling paths of slightly different lengths before arriving at a detector such as a photographic film. When the path length differs by half a wavelength, the waves destructively interfere, resulting in a dark band on the film. When the path lengths differ by a wavelength, then the waves constructively interfere, producing a bright band on the film. A diffraction grating consists of small slits separated distances of the order of the wavelength of the incident light. We saw above that when a DC magnetic field of sufficient strength is applied perpendicular to the magneto fluid film, an equilibrium 2D hexagonal lattice is formed with columns of nano-particles occupying the lattice sites. This structure can act as a 2D optical diffraction grating that diffracts incoming visible light.

Thus diffraction pattern is determined by the equation

$$d \sin \theta = n \lambda$$

where  $d$  is the distance between the chains of nano-particles, where  $\theta$  is the angle between the outgoing light and the direction normal to the film,  $n$  is an integer, and  $\lambda$  is the wavelength of the light. We saw earlier that the distance between the chains  $d$  depends on the strength of the applied DC magnetic field. In effect, we have a tunable diffraction grating, which can be adjusted to a specific wavelength by changing the strength of the DC magnetic field.

## II GENERAL METHODS FOR THE SYNTHESIS OF NANO- MATERIALS

The two major approaches currently being used for the generation of organized nano-scale assemblies are the “top down” (“engineering down”) and “bottom up” (“engineering up”) methods.

### a) Top Down Method

Top down method is the process for the synthesis of ultra fine particles from their bulk cousins by continuous grinding process. This is the traditional way of synthesis of nano-particles from their crystalline bulk counter parts synthesized by ceramic technique. Generally a “Two roll mill” is used for the reduction of grain size of the powder specimens. Nowadays high energy ball milling (HEBM) has taken over the conventional roll mills which can impart high momentum to the milled powders through the high speed rotation and revolution of the vials which helps in obtaining high efficiency in low milling times. Also thin films consisting of nano-grains could be synthesized from bulk materials by variety of other techniques like vacuum evaporation, RF sputtering, pulsed laser ablation etc.

### b) Bottom Up Method

It is the ideal and mostly employed method for the synthesis of nano-particles nowadays. In this method nano-materials are grown slowly from the atomic scale mostly by chemical methods in which careful control of the preparation parameters like pH, temperature, etc. to tune the grain size in a favourable way. Chemical co-precipitation, sol-gel, etc. are usually employed for the synthesis of ultra fine powder particles in this technique.

In these films, there are several techniques for the growth of ultra fine grains on a substrate by atom by atom deposition like physical vapour deposition. Also there are chemical methods for the synthesis of fine grained thin films by processes like chemical vapour deposition, chemical bath deposition, spray pyrolysis, sol-gel, dip coating, chemical co-precipitation etc.

Of the two techniques, bottom up process is advantageous for the synthesis of ultra fine powder sample as it provides atom by atom growth there by reducing the surface imperfections and strain that could be imparted in the milling process and careful control of the preparation condition could ensure systematic tuning of the grain size and other characteristics of these powder particle. So nowadays chemical precipitation techniques and sol-gel process gain an upper hand in the nano-particles synthesis, however top down process like PLD and RF sputtering has been extensively used for thin-film fabrication.

### **Sol-Gel Method – The method used here for the preparation**

Sol-Gel method involves formation of an amorphous gel from a solution followed by its dehydration at an elevated temperature.

Many fine ceramics have been prepared by the sol-gel method using different metal ion precursors. The particle sizes in this process varied from 50 to 300 nm according to the experimental conditions.

Of the two techniques [Top Down Method, Bottom Up Method] Bottom up process is advantageous for the synthesis of ultra fine powder sample as it provides atom by atom growth there by reducing the surface imperfections and strain that could be imparted in the milling process and careful control of the preparation conditions could ensure systematic tuning of these powder particles. So now days chemical precipitation techniques and sol-gel process gain an upper hand in the nano-particles synthesis.

As discussed above several chemical methods including co-precipitation solid-state reactions, supercritical drying process, micelle routes and hydrothermal synthesis have been used to prepare the ferrites.-The samples prepared by different methods had obvious difference in morphology. Both solid-state reactions and co-precipitation are canonical for producing large quantities of nano-particles, but undesired non-uniform particles were easily formed due to agglomeration of nano-particles.

Alternatively sol-gel is an efficient method for preparing nano-materials at moderate condition and is believed that sol-gel derived nano-particles generally possessed good chemical homogeneity, high purity and low calcinations temperature. It facilitated the formation of particles which consisted of many nano-crystallites and which possessed super paramagnetic properties.

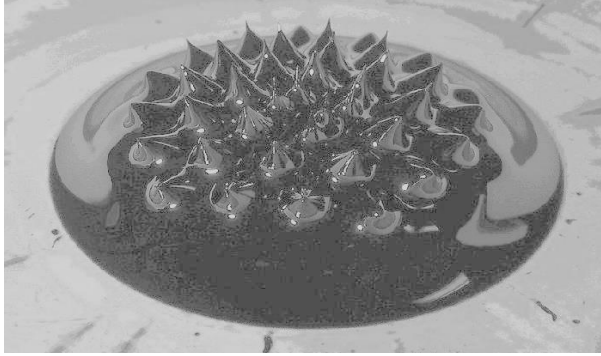
## **III EXPERIMENTAL TECHNIQUES**

### **a) PREPARATION COBALT FERRITES**

Sol-gel method was used for the preparation of Cobalt ferrite nano-material. In this method a definite stoichiometric molar proportion (2:1) of  $\text{Fe}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$  were dissolved in ethylene glycol. When the mixture was being magnetically stirred at  $60^\circ\text{C}$ , the mixture was transformed into soft gel. After stirred for about 10 hour, the soft gel was turned into black gel. The gel was dried at  $100^\circ\text{C}$  for 3 hour in the high temperature oven. Finally the dried gel was fired in the high temperature muffle furnace for 12 hours until a black product was formed. This black product is taken in a crucible and powered manually. Thus we obtain the inverse spinal-type  $\text{CoFe}_2\text{O}_4$  which has both special crystal and electron structures. About 4 samples were prepared and the one named **SSII** was used for further analysis and experiments.

## b) PREPARATION OF FERROFLUID CONTAINING COBALT FERRITE NANO-PARTICLES

A definite amount of the above prepared cobalt ferrite was taken and dissolved in oleic acid which acts as the solvent. The mixture was milled and grinded in a homemade ball-milling unit for about 2 days continuously. To this 5-6 ml of white kerosene was added which acts as the surfactant. The entire system was milled in the same ball-milling unit for about 12 hours. Thus we obtain the black color Ferro-fluid which was found to be magnetic in nature. The behavior of a ferro-fluid when exposed to a high intense magnetic field is shown below.



## IV RESULTS & DISCUSSIONS

### A) XRD ANALYSIS

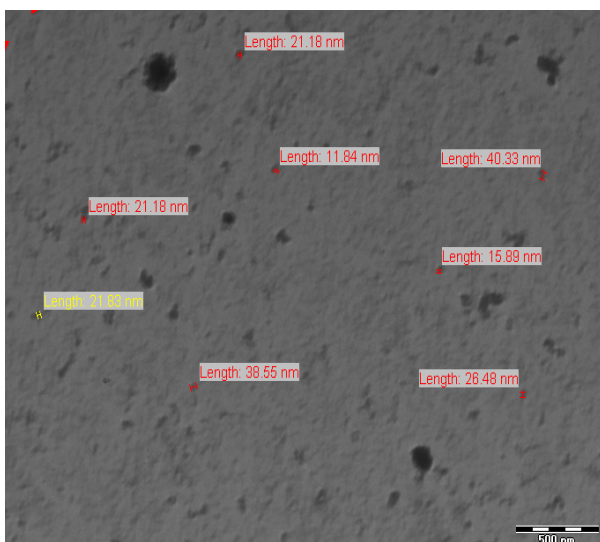
The initial studies were conducted using X ray diffraction. The XRD spectrum of **SSII** is shown in the fig below. The fig I shows the real XRD spectrum with intensity on the Y axis and  $2\theta$  scale on the X – axis. In the fig II the corresponding peaks of cobalt ferrite are depicted with their ' $2\theta$ ' values and the 'd' values. The grain size and the lattice parameters could be calculated using the Debye- Scherrer formula given as

$$d = k\lambda / \Delta \cos \theta$$

But the noise in the x ray spectrum prevented from the detailed studies of structural characters of samples. The XRD pattern of sample **SSII** is shown in the fig below. It shows the appearance of a high intense peak at  $2\theta = 44.4050$  corresponding to  $\text{CoFe}_2\text{O}_4$  with inverse spinel structure. The grain size & lattice parameters of the crystal sample can be calculated from the pattern by using the Debye-Scherrer formula.

### B) TEM ANALYSIS

The secondary analysis was done using the transmission electron microscope. The result is depicted below pictorially. The particle size is marked on the top of each particle.



## CONCLUSION

Here we synthesized nano-magnetic materials of Cobalt ferrite using sol gel method. The initial studies were conducted using X ray diffraction. The noise in the x ray spectrum prevented from the detailed studies of structural characters of samples. But the transmission electron microscope (TEM) analysis confirmed the nano particle formation of cobalt ferrite in the samples synthesized. Here we succeeded to reduce the particle size even below 10 nm. This enables us to continue this work to produce quantum dots. Here we used this nano sized powder sample to develop ferro-fluid.

We succeeded to develop ferro-fluid with optimum characteristics. Hence scope exists to continue this work, not only to develop new applications for the nano magnetic particles synthesized, but also to develop magnetic fluids for different applications. Some of the applications for the ferro-fluid are the use of liquid seals around the spinning drive shafts in hard disks and friction-reducing fluids in machineries.

### Message From Prof. Alex Punnoose



Dear Cherian sir,

Thank you so much for your kind e-mail. My health remains more or less the same as last time when we contacted. The tumor is still in my abdomen and the plan is to remove it through a very risky surgery and this will also need to transplant my small bowel and abdominal wall. A very specialized surgeon at New York has agreed to do this, but he did not give us a firm date yet. But I hope it will happen within the next 6 months time. Once this surgery is successfully completed, the doctor believes that I will return to normal health. However, as I mentioned, this is an extremely risky surgery and I need your prayers very much. God has done a ton of miracles on me, so I am confident that He will take care of the rest also.

I really can't believe that it is time for you to retire. You still look so young and energetic. I wish if I could be there at your retirement function. Unfortunately, my health situation will not allow that, but I will visit you whenever I visit Kerala next time. You are one of the very best professors I ever had in my life and your classes really made me very interested in Physics. You can certainly claim a big part in making me a physicist.

I am very sorry for the delay in getting you the scientific article for the Ruby Jubilee Souvenir. I got my students scan a recent article that came in Focus magazine. This article talks about a nanobiotechnology research group that I started and led to success. As you might know, my recent research was on nanotechnology and in 2006, I started applying some specially designed nanoparticles to kill certain bacteria and cancer cells without any side effects to healthy human cells, with the help of some biology and medical researchers. In 2008, we published our first ever finding that our specially made nanoparticles can kill cancer cells and bacteria without any adverse effect to normal healthy cells. Comments about this finding came in many magazines and newspapers including the Chicago Tribune. The attached article is one of them which talks about this new discovery, the research team and key players. I was admitted in the hospital when this article came out. Hope this will be suitable for including in the Souvenir. I will also send you my brief CV in case you need any information from that, in a separate e-mail. Would it be possible to get a copy of the Souvenir? My mailing address is

Alex Punnoose

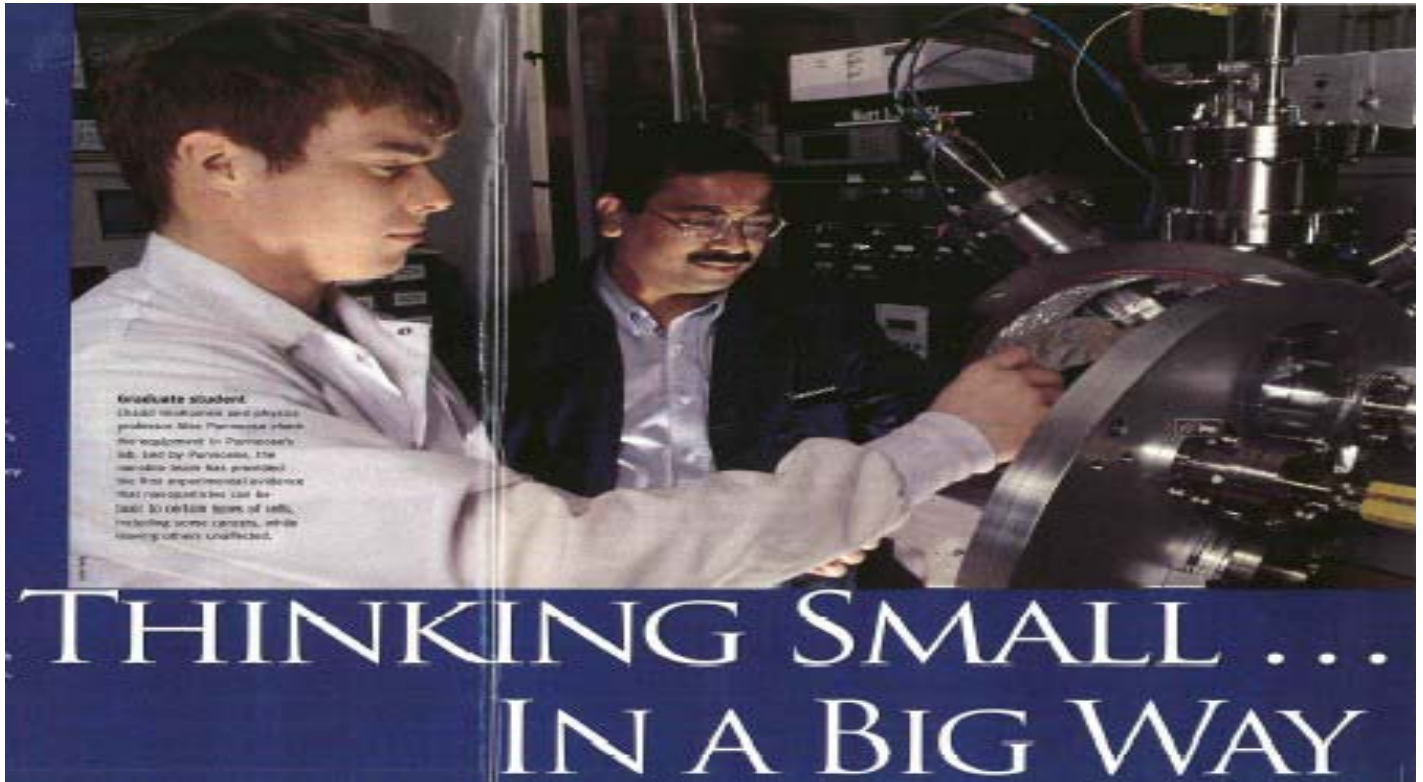
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Boise, ID 83716, USA.

Thank you again and good luck with the Souvenir.

Alex

## NANO BIO TECHNOLOGY



“ Humans are in a war with microbes, and we are losing” The stark reality of that statement, a quote from the professor of a microbiology class at another university, took Boise State physics professor Charles Hanna by surprise, despite his years of scientific training and a general understanding of its truth.

Today, it serves the theoretical physicist as a reality check of sorts. It reminds him that the task facing a small group of biologists, physicists, engineers and chemists from Boise State is nothing short of monumental. The dizzyingly fast mutations of bacteria and other microbes - the cause of often deadly infections increasingly plaguing hospitals and their patients - have been perplexing scientists since the invention of antibiotics.

Despite the odds, when Hanna, Alex Punnose, Denis Wigett, Kevin Perls and other members of Boise States “nanobio” group talk about the foundation for effective treatments that could save grandparents from infections and grand children from the agonies of leukemia.

They believe that the varied backgrounds, expertise and perspectives of this highly interdisciplinary team of researchers is starting to unravel a new world of possibilities.

They hope that using nanotechnology to answer fundamental questions of biology and medical research will not only help fight mankind’s war against microbes, but aid in our long-standing pitched battle with cancer as well.

The promise of the group’s work is built on nanoparticles-very small pieces of often common materials that measure between one and 999 nanometers (a human hair is about 100,000 nanometers wide). At nanoscale size--as the materials become smaller and the ratio of their surface area to volume



Members of BOISE STATE'S Nano Bio group

increases - everyday materials can become fabulously versatile and unpredictable. For eg., a sample of copper, normally known for its malleability, becomes super hard in pieces smaller than 50 nm. in length.

In other words, nanoparticles of familiar materials can do unfamiliar and, under the right circumstances, exciting things. The key, however, is to understand which ones do what.

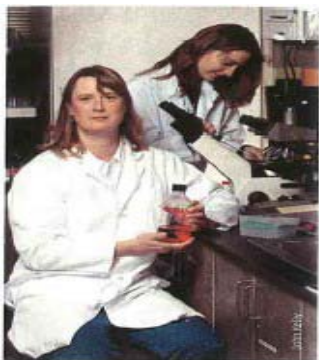
Nano particles aren't just getting attention from Boise state scientists. No matter their fields of expertise, researchers everywhere are beginning to understand that the realm of nanoparticles is a world of great scientific potential where spectacular discoveries almost certainly await.

Led by Punnoose, a physics professor whose synthesis of nanoparticles previously focused on their use in semi-conductors and nanoelectronics, the Boise state nanobio team has provided the first experimental evidence that nanoparticles can be toxic to certain types of cells while leaving others unaffected.

Punnose conducted these initial experiments with Feris, an assistant professor of biology and microbial ecologist, just over two years ago - marking the informal beginning of the nanobio team at Boise State. Since that time, the group has grown to include seven faculty level members, three graduate students, two post doctoral fellows and ten under graduate students, each with specific expertise in areas of interest for the group.

Feris and Punnoose's work using zinc oxide nanoparticles to kill certain types of bacteria led to the publication of a well received paper and the inclusion of Wingett, a biology professor and cancer researcher, in their discussions and experiments. "Alex thought, 'well, if this works on microbes, what about cancer cells?'" Wingett says.

It was the nanobio group's most celebrated success - the discovery of an effective method for using zinc oxide nano particles to preferentially kill immune cell cancer while leaving ordinary cells healthy. It also led to the group's second paper which created a buzz in the scientific sphere when it was published over the summer.



Biology Professor Denise Wingett

Wingett blanches at the word “breakthrough” - the experiments so far have only focussed on immune cell cancers. Yet the discovery could, one day, become the basis for new cancer treatments that lessen, or possibly eliminate, the debilitating effects of chemotherapy. As the group’s cancer expert she will try to determine whether nano particles can be effective against other types of cancer.

Its heady stuff for an all - Boise State team of researchers. These experiments and findings are on the cutting edge of research. These

scientists are the first to explore this particular corner of the nano particle world and its specific potential for deployment in mankind’s microscopic struggle for survival.

“This is an extra ordinary opportunity for an emerging research university like Boise State,” says Wingett, who serves as the associate chair of the Department of Biology and is a Boise State grad.” just think of the possibilities”.

Nano particles inside human cells kill their hosts by disrupting the normal chemical reactions and structures a cell needs to survive. The lethal mechanism is not as clear with bacteria.

“We need to know more about why particular nano particles are effective and others are ’nt”, Hanna says. “We need to know what happens when that nano particle gets close to that cell.”

One idea, introduced by Hanna, is that the atomic charge of zinc oxide changes at the nano particle level, creating a fatal reaction with outer membrane of the bacteria.

Atomic charge is behind another theory the group is working on called “functionalizing”. By manipulating the atomic charge and other characteristics of a nano particle cluster, the team thinks that the cluster can be used to ‘tow’ chemotherapeutic drugs or other medications directly to cancer cells or infection causing bacteria using a third agent. Using the natural attraction between opposing charges, medications could be delivered with better than pin point accuracy, allowing for a greatly reduced dosage.

Hanna’s role with the group is largely limited to theoretical “what would happen if” kind of work; he quickly points out that the laboratory scientists are the ones doing the heavy lifting. Yet his idea that atomic charge could be one of the contributing factors to zinc oxide’s effectiveness is a prime example of the benefits of interdisciplinary research.

“We all bring different perspectives to the problems we face, so it broadens the way we look at solutions,” says Hanna “the really innovative thinking comes from the areas where the outer edges of our various disciplines overlap”.

It creates a dynamic where both faculty members and students are moving out of their comfort zones and learning in areas outside of their typical silos. Students particularly benefit from working so closely with scientists from another discipline.

“Students tend to think about science only through their own areas of focus,” Feris says. “We have some engineering and physics students who are learning to think like microbiologists. It is really broadening every one’s perspective, including my own”.

The various individual researchers bring specific expertise to particular areas of interest for the group.

Hanna, a theoretical physicist, will create 'predictive models' to mark nano particles with specs known to be effective, which can then be manufactured in punnoose's laboratory. He also provides insight into the physical reactions that biologists observe in their experiments.

Juliette Tinker, a biology professor and microbe specialist, will continue studies on the potential for treatment of increasingly dangerous bacterial infections using nano particles.

Wingett and biology professor Kristin Mitchell are starting to work on in vivo or living cell experiments with mice to, among other things, determine the most effective dosage levels for various nano particles. These experiments with mice are the first step toward human testing and, ultimately, bona fide treatments using these techniques. If all goes perfectly - a big if - testing and final approval of such treatments could happen in about a decade.

By covering so many areas of specific expertise, the team also will be more likely to attract all important funding from organizations like the national institutes of Health and National Science Foundation, which actively seek opportunities to fund innovatively. Promise of their work has attracted more than one million dollars in grants to buy equipments needed to expand the scope of their research - just a drop in the bucket for what would be needed to ultimately develop treatments.

"It is really just a matter of time before we drop in a big grant", says Feris, the microbial ecologist who will help the team understand the "environmental fate" of nano particles or how their use will impact the environment, a key question if these methods are ever to become wide spread.

Moving forward will take a lot of time, sweat and money. "But", Wingett says, "It is worth it".

### About Alex

**Alex Punnoose** was an undergraduate Physics student of this college during 1985 - 1988. He took his PhD from Aligarh Muslim University and post doctoral research was in West Virginia University. At present he is the professor of physics, Boise State University U.S.A. He has got 89 published papers to his credit in various leading journals in addition to the 71 papers presented in various conferences all over the world. By this time he has obtained 5 patents for his researches in different fields. He represented Uzhavoor St. Stephen's Collge in the Mahatma Gandhi University union in 1988. He is a person of pride for our college.

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 ØPøßB Z °U ßæÜPÄáAß Èà;  
 ÈF ðÄB {ßW ÈBK á ¼Èß°ÖX Èà !

ØçÈÜ ØPøß Èà,  
 Ößi VMßæaI áMi, µHáÈàøßæa Äß{Aç  
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 øÞsÎÞi i, ¼áÖÈÞi i  
 ÄçÜÞçáç µÞxÞi i, ÄÄÜÞi i  
 æÉI ßüB áK á Èà.  
 çÆÖPL øB Z ÈøA áK á Èà...

çÈVÖÝßæ° ÞÜßæA ÞçáA áç sáøá  
 ÖáÝP ii ßæÜPøá ÄÞB i  
 °i øáÖÞæÈÞøá µÞðÄç  
 ÈúI áÖÞçÈæù µÞøçB Z  
 ¥ÜI çBA áK ØI áðÆç ÈßæaI áUßW  
 æÉI ñçÉÞÖáK á ÖàI áç ÖàI áç

ÈBK ßçÜæA ÞÝáµáK á ÈÆßµZ  
 ØçÈÜÎÞi i Èwßi Þi i  
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 è µ ÈàGá ÖÞB çÖ  
 ¥Üßi áK ÞÜÜÖáI !  
 ÎùK áçÉÞi i µáJ ßçÈÞÖß°iÎáU áµZ  
 ÈÞÝÜÞi iÎáçßi ðsÜÄB Z,  
 ¼áÖßÄç ÄæK ÜÜøß  
 ÈF ðÄæI K á Öß{BA æG ÈßæK ¾PX

¥ÖV ÈùE á,  
 ÎHßçÜA áÎçB áK á Èà;  
 ÉçF .. ...  
 ÎHßÜÜßi ÞæÄ, °ÞÄI ßæÜøßi ÞæÄ  
 ÎùÖßi ßW ÎùÖáæ° i ÞæÄ  
 Èßæa ØbÉÈB Z !

ÖÞi Þ° ñÄáVK ÉáØµJ ÞçßæÜI F øççÉÞW  
 Èà æ° i ñÉáÄçB Z ÎÈTßW,  
 ØçÈÜA áGáµZ °ÞÜß° ñÖ° ñÖß{Ößi  
 Èúáøá° ÞµæçÞæA I áç ÈÞÖßW,  
 Îáçç ÄæI ÞçBE ÞÜáç Èà æÉÞÝß° i  
 ØçsáÄç µÞÄßW.

SÜµZ æµÞÝßE á; .. ÎøJ ÞÈá  
 «áÄáA æçðÄ Î ÞAß?  
 ÖáÄ ÈáÖßÈi ØççæI L ÞÈ?  
 ÉáÄá¼Z B {ßÈßi áç Î ÞAß.  
 ¥ÈáI ÞðÄ ÖßçøáI à ðÉÉF J ÞW  
 ÁæøB {ßÈßi ææIðÄ Î ÞAß?

ØÄÜµPÜB Z, °ßL i áç  
 ÈÞOP Ü. നിശ്ചിന്ത്യമാകും. ÖçøI iA áç.  
 SÖßæç ÈàI áI i ¾PÈáç.



## Brighter Moon

### Why is the Moon bigger and brighter only once a year?

*The moon takes 27.3 days to complete one revolution around the earth. Since, the earth has moved a bit in the same period of time, it takes further two days to catch up with the earth. Hence, full moon - new moon lunar cycle takes 29.5 days.*

*The moon's orbit around the earth is elliptical, and its orbit is inclined at 5.14 deg. to the elliptic (earth's path around the sun) with a substantial eccentricity of 5.49 percent (earth's is 1.67 percent). The moon's mean distance from the earth is 384,400 Km. The nearest point on its orbit from the earth is called perigee and the farthest is called apogee. The higher the eccentricity, the more extreme apogee and perigee is.*

*This apogee and perigee distances vary in every cycle albeit in small amount. The moon is shining because it reflects sunlight. It reflects only about 7 percent of the sunlight incident upon it. Ignoring the moon's minimum and maximum distances from the sun, the only significant factor contributing to its brightness (and size) for an observer on earth is the moon's distance from the earth.*

*When the moon is full and it is near the perigee, it will appear bigger and brighter, as it is at its closest point to the earth. Like wise, it will appear smaller and least bright (full moon) when it is near the apogee.*

*To observe fully this variance, the full moon day has to be at or very close to the perigee. Many times this phenomenon does not occur. In those full moon days, this extreme variation is not fully observed. Hence, the moon's size and brightness vary at every full moon.*

*The mean ratio of apogee -to - perigee is 1.13. Since light intensity varies as the square of the distance, the moon's brightness is nearly 27 percent more (and about 13 percent bigger in size) at perigee than at apogee. For 2010, the biggest and brightest fullmoon happend on January 30 (perigee on the same day is at 3,56,592 Km.) and the coming full moon on August 24 will be close to the apogee (August 25, 4,06,389 Km).*

*On other full moon days, the moon size will be in between. The orbit of any celestial body is never constant. Ther will be minute variations.*

### RUBY JUBILEE CELEBRATIONS



Get - together after a looong time .....







# “ çÕøxá çÉpμáK ÄBÈá ÎáçO..... ”

PRIYANKA K.P.I M.Sc.

²øá ÄáçA ç...

²øBA Üáç ²çáB pJ ²øá ÄáçA ç .....  
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# The Changing Climate

The drowning Sundarbans, receding gangotri, excessive and untimely rain in Maharashtra and unprecedented droughts in Madhya Pradesh, seen in isolation, these events may seem like random coincidences. Put it all together and the story that emerges is of an impending catastrophe. As mankind raced towards industrial and consumption driven development goals, the concept of sustainability got lost somewhere along the way.

While we, the common people, might think that climate change is something that only the people living in the coastal regions and politicians have to worry about, the truth is quite the opposite. Every thing that we depend on for our day today sustenance is directly affected by how the climate evolves over time. Be it the wheat and rice crops that get ruined due to untimely rains, there by pushing up the prices, or the health care situation in the country, that gets worse due to the increasing cases of vector borne diseases.

The Copenhagen Accord has failed to recognise this. Led by the world's most powerful leaders, 192 nation leaders came together at the Copenhagen Summit but left without making binding commitments. Ironically it is the poor and marginalised people, who have not contributed to climate change, that are and will be the most affected by climate change. The Kyoto Protocol was symbolically an important step, but it failed to deliver a major effort toward green house gas reductions. In the absence of a new mindset, the Copenhagen Accord will mean more years of the same waiting game. Countries will continue free-riding. While global temperatures continue to rise, glaciers melt and ultimately people's livelihoods and lives are lost.

The world needed a fair, ambitious and 'operationally binding political deal' to be reached at Copenhagen. We have lesser time left for drastic global action to reduce Green House Gas emissions. The Himalayan glaciers may not be melting as fast as we were told, but for common people and for politicians who represent them, climate is changing and the impacts are there for us to see.

That we need to do something urgently to slow this, is a well known fact now. but 'What can be done' is a fact on which consensus has so far been elusive.

The Climate Summit in Copenhagen was the 15th attempt by the world leaders to come to a common ground to discuss and possibly resolve the situation. However, if the same blame game continues it will be near impossible to resolve and truly tackle this complex problem.

The developed world needs to understand and acknowledge the development needs and aspirations of the countries like India, China and Brazil. Especially in the light of the fact with its current population India still accounts for only 5 percent of the global emissions, where as the U.S. is responsible for 20 percent. The disparity was much higher in the past.

The U.N. Framework Convention on Climate Change (UNFCCC) presents us not only with a global platform to voice our concerns but also a democratic platform where powerful and less powerful countries can talk on equitable terms. Any move forward from Copenhagen still needs to ensure that developed countries like U.S., make binding commitments that are fair and ambitious at the same time. Furthermore, developing countries are provided enough financial and technological support to ensure a smooth and viable transition to low carbon growth societies.

From India's domestic perspective, the current times present a phenomenal opportunity to start building a low carbon economy. By doing this, India will not only be able to sustain its economic and industrial growth but also ensure that its social developments targets like rural electrification are met in a climate friendly way. The battle, however, will have to be fought on two fronts - 'Improving efficiencies in the existing infrastructure' and 'speeding up the implementation of new projects' like 'Sustainable Habitat Mission' and 'Solar Mission'.

It is only when India takes a leadership position in its global as well as domestic approach that the 'developed' will be shamed into correcting their own wrong doings. It is critical that we, as a nation, take a stand in post Copenhagen and lead the global climate debate; strongly putting our point across, with out getting intimidated or influenced by international pressure.

Needless to say that the benefits of these efforts would be phenomenal, both for the world economy and our own as well. Ultimately, every year of delay in our addressing the climate change situation results in a loss of close to \$ 500 billion. - Courtesy - The Hindu, Feb. 10, 2010

## **IT IS HOT..... PHYSICS AROUND THE KITCHEN** (contd. from last issue)

Lally K. Cyriac

These puzzles are meant to be fun. You solve it or not is not as important as how many you enjoy thinking about it. I hope somebody who has had some exposure to introductory physics and is eager to learn about its applications can enjoy it.

### ■ **Singing of kettle**

We are all familiar with the hissing sound that starts a few moments after the kettle is put on fire. This sound gradually increases and then suddenly drops, when the water starts to boil. Have you ever wondered what causes the kettle to 'sing'?

### ■ **Spoon in a tea cup**

An experienced house wife often puts a metal spoon into the china cup before pouring hot tea into it. Why?

### ■ **Sticky Ice Tray**

Have you ever tried to hold a cold frosted ice tray? If you have, you must have noticed that your fingers tend to stick to the tray. Why? Don't ever try to lick the tray--it will be a very painful experience!

### ■ **Spilling Milk**

One of the regular botherations for a house wife is the nuisance caused by milk spilling over

For Answers see page **no. 42**

**Indian Scientists**

# Satyendra Nath Bose

Vivek Grigrious III DC Physics



**Satyendra Nath Bose** (1 January 1894 – 4 February 1974) was an Indian physicist, specialized in mathematical physics. He is best known for his work on quantum mechanics in the early 1920s, providing the foundation for Bose-Einstein statistics and the theory of the Bose-Einstein condensate. He is honoured as the namesake of the boson. He was awarded India's second highest civilian award, the Padma Vibhushan in 1954 by Govt. of India.

Although more than one Nobel Prize was awarded for research related to the concepts of the boson, Bose-Einstein statistics and Bose-Einstein condensate—the latest being the 2001 Nobel Prize in Physics, which was given for advancing the theory of Bose-Einstein condensates—Bose himself was never awarded the Nobel Prize. Among his other talents, Bose spoke several languages and could also play the *esraj*, a musical instrument similar to a violin.

In his book, *The Scientific Edge*, the noted physicist Jayant Narlikar observed: S. N. Bose's work on particle statistics (c. 1922), which clarified the behaviour of photons (the particles of light in an enclosure) and opened the door to new ideas on statistics of Microsystems that obey the rules of quantum theory, was one of the top ten achievements of 20th century Indian science and could be considered in the Nobel Prize class.

## ***Early life and career***

Bose was born in Kolkata (Calcutta), India, the eldest of seven children. His father, Surendranath Bose, worked in the Engineering Department of the East Indian Railway Company. Bose attended Hindu School in Calcutta, and later attended Presidency College, also in Calcutta, earning the highest marks at each institution. He came in contact with teachers such as Jagadish Chandra Bose and Prafulla Chandra Roy who provided inspiration to aim high in life. From 1916 to 1921 he was a lecturer in the physics department of the University of Calcutta. In 1921, he joined the department of Physics of the then recently founded Dhaka University (now in Bangladesh and called University of Dhaka).

In 1924, while working as a Reader at the Physics Department of the University of Dhaka, Bose wrote a paper deriving Planck's quantum radiation law without any reference to classical physics and using a novel way of counting states with identical particles. This paper was seminal in creating the very important field of quantum statistics. After initial setbacks to his efforts to publish, he sent the article directly to Albert Einstein in Germany. Einstein, recognizing the importance of the paper, translated it into German himself

and submitted it on Bose's behalf to the prestigious *Zeitschrift für Physik*. As a result of this recognition, Bose was able to leave India for the first time and spent two years in Europe, during which he worked with Louis de Broglie, Marie Curie, and Einstein.

After his European sojourn Bose returned to Dhaka in 1926. He became a professor and was made head of the Department of Physics, and continued teaching at Dhaka University until 1945. He was also Dean of the Faculty of Science at Dhaka University for a long period. In 1944 Bose was elected General President of the Indian Science Congress. When the partition of India became imminent, he returned to Calcutta and taught at Calcutta University until 1956, when he retired and was made professor emeritus. In 1958, he became a fellow of the Royal Society.

### ***Bose–Einstein condensate***

There are three outcomes. What is the probability of producing two heads?

Since the coins are distinct, there are two outcomes which produce a head and a tail. The probability of two heads is one-quarter.

While presenting a lecture at the University of Dhaka on the theory of radiation and the ultraviolet catastrophe, Bose intended to show his students that the contemporary theory was inadequate, because it predicted results not in accordance with experimental results. During this lecture, Bose committed an error in applying the theory, which unexpectedly gave a prediction that agreed with the experiment. (He later adapted this lecture into a short article called *Planck's Law and the Hypothesis of Light Quanta*.)

The error was a simple mistake—similar to arguing that flipping two fair coins will produce two heads one-third of the time—that would appear obviously wrong to anyone with a basic understanding of statistics. However, the results it predicted agreed with experiment, and Bose realized it might not be a mistake at all. He for the first time took the position that the Maxwell-Boltzmann distribution would not be true for microscopic particles where fluctuations due to Heisenberg's uncertainty principle will be significant. Thus he stressed the probability of finding particles in the phase space, each state having volume  $h^3$ , and discarding the distinct position and momentum of the particles.

Physics journals refused to publish Bose's paper. It was their contention that he had presented to them a simple mistake, and Bose's findings were ignored. Discouraged, he wrote to Albert Einstein, who immediately agreed with him. His theory finally achieved respect when Einstein sent his own paper in support of Bose's to *Zeitschrift für Physik*, asking that they be published together. This was done in 1924. Bose had earlier translated Einstein's theory of General Relativity from German to English.

The reason Bose's "mistake" produced accurate results was that since photons are indistinguishable from each other, one cannot treat any two photons having equal energy as being two distinct identifiable photons. By analogy, if in an alternate universe coins were to behave like photons and other bosons, the probability of producing two heads would indeed be one-third (tail-head = head-tail). Bose's "error" is now called Bose-Einstein statistics.

Einstein adopted the idea and extended it to atoms. This led to the prediction of the existence of phenomena which became known as Bose-Einstein condensate, a dense collection of bosons (which are particles with integer spin, named after Bose), which was proven to exist by experiment in 1995.

Bose's ideas were afterwards well received in the world of physics, and he was granted leave from the University of Dhaka to travel to Europe in 1924. He spent a year in France and worked with Marie Curie, and met several other well-known scientists. He then spent another year abroad, working with Einstein in Berlin. Upon his return to Dhaka, he was made a professor in 1926. He did not have a doctorate, and so ordinarily he would not be qualified for the post, but Einstein recommended him. His work ranged from X-ray crystallography to unified field theories. He also published an equation of state for real gases with Megh Nad Saha.

Apart from physics he did some research in biochemistry and literature (Bengali, English). He made deep studies in chemistry, geology, zoology, anthropology, engineering and other sciences. Being an Indian of Bengali descent, he devoted a lot of time to promoting Bengali as a teaching language, translating scientific papers into it, and promoting the development of the region.

## IT IS HOT.....

### Answers

#### Singing of kettle.

It is the bottom layer of water in the kettle that gets heated first. As the temperature rises, steam bubbles form at the bottom. Being lighter than water, they rise and come in contact with the cooler layers of water above, contract and eventually collapse. It is the collapse of a myriad steam that produce hissing sound. The sound, therefore, increases as more and more steam bubbles form and collapse. Eventually however the entire mass of water is heated to boiling point, the steam bubbles, do not collapse any more, because, they no longer encounter cooler layers of water. The hissing therefore ceases, and the whole mass of water in the kettle starts boiling.

#### Spoon in a cup

a good house wife puts in a metal spoon because metals are good conductors of heat. The rest is left for you to work out.

#### Sticking Ice Tray

There is always some moisture on your finger. When you touches the frosted sides of the ice tray, this moisture freezes and the pressure of your fingers makes the frozen moisture stick to the ice crystals on the tray. Do not lick an ice tray. If you try to lick the tray, your tongue will stick to it and a layer of skin may be ripped off.

#### Spilling milk

Every one knows that a layer of skin forms on the surface of milk when it is heated. This is because some of the fat in the milk separates. All the steam bubbles formed within the milk get trapped by this skin. It is the pressure of the trapped steam that eventually raises the skin and makes some of the milk spill. The stirring breaks the skin, releases the pressure and prevents the spill over.

### ®æa ¼àÖBÄ ÖÆcpÜi t

Sreejith K.K. (Alumni 1992 – 99)

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# SELF TREATMENT - PRONS & CONS

Merin James M.Pharm

This is an article which explains the illeffects using medicine by our own, with out consulting an authorized physician.Certain medicins do much harm if used at the wrong time, in the wrong dose - **Beware!!**

Here is a list of commonly uesd medicins and its side effects

## 1. PARACETAMOL ( Acetaminophen)

**Category:** Analgesic & Antipyretic ( No antiinflammatory)

**Use:** Mild to moderate pain and fever.

**Warnings:** Use caution with patents of liver disease.

**Side effects:** rashes, nausea, vomitting,nephropathy, hypersensitivity.

**Over dosage:** Anemia, liver damage.

## 2. DICLOFENAC

**Category:** Non steroidal anti inflammatory drugs.

**Use:** acute treatment of mild to moderate pain, acute and chronic treatment of rheumatoid arthritis, osteo arthritis, dysmenorrhea.

**warnings:** Use cation in patients with congestive heart failure, hypertension, renal/hepatic dysfunction.

**Side effects:** Skin rash, abdominal cramps, heart burn, indigestion, nausea, dizziness, nervousness, GI ulceration, Vomiting.

**Over dosage:** Nausea, vomiting, stomach pain

## 3. IBUPROFEN

**Category:** Non steroidal anti inflammatory drugs.

**Use:** Inflammatory diseases & rheumatoid disorders, mild to moderate pain, dental pain, migraine, dysmenotrhea, headache.

**warnings:** Use cation in patients with congestive heart failure, hypertension, renal/hepatic dysfunction.

**Side effects:** GI bleeding,dyspepsia,nausea,vomiting,ulcers,acute renal failure,nephrotic syndrome, skin rash, fever, chest pain, ringing in the ear.

**Over dosage:** Metabolic acidosis, coma, renal failure, stomach pain, drowsiness, black or bloody stools, coughing up blood, fainting.

## 4. CETRIZINE

**Category:** Second generation antihistamine.

**Use:** Symptomatic relief of hypersensitivity reactions, Allergic symptoms like watery eyes, sneezing, running nose.

**Side effects:** Sedative effect, dizziness, nausea, vomiting, diarrhoea or epigastric pain, dry mouth.

**Over dosage:** Feeling restless or nervous and feeling drowsy.

## 5. LOPERAMIDE HYDROCHLORIDE (for diarrhoea)

**Use:** Inhibit intestinal mobility & used in the mamagement of acute and chronic diarrhoea.

**warnings:** Caution in patients with liver dysfunction. Should not used if diarrhoea accompanied by high fever, blood in stool.

**Side effects:** nausea, dizziness, Sedation, fatigue, constipation.

**Over dosage:** Central Nervous System(CNS) depression, GI irretation, respiratory depression, liver dysfunction,urinary retension.

## 6. RANITIDINE (for Gas)

**Use:** Gastric and duodenal ulcer, prevention of stress induced ulcer

**warnings:** Use caution in children below 12 years and patients with liver/renal impairment.

**Side effects:** Hepatitis, dizziness, Sedation, malaise, Head ache, skin rash, fever, sour throat

**Over dosage:** Symptoms of muscular tremors, vomiting, rapid respiration, renal failure, CNS depression

## 7. OMEPRAZOLE ( for gastric ulcer)

**Use:** Gastro - oesophageal reflux disease, peptic ulcer

**warnings:** Long term studies revealed that it may cause dose related gastric carcinoid tumors

**Side effects:** Diarrhoea, skin rash, head ache, dry mouth, muscle pain, weakness.

**Over dosage:** Lowering of body temperature, sedation, convulsions, blurred vision, fast heart beat.

## 8. CHLORPHENIRAMINE MALEATE

**Use:** Seasonal allergic rhinitis and other allergic symptoms including urticaria, rashes, cough, sneezing, running nose. It is a common ingredient of cough and cold medicines.

**Side effects:** nausea, dizziness, Sedation, constipation, irritability, weight gain, chest tightness, wheezing, increased appetite.

**Over dosage:** CNS stimulation /depression, respiratory depression.

## 9. METFORMINE

**Use:** Oral anti diabetic medicine that control blood sugar level.

**Side effects:** Produce unpleasant metallic tastes, stomach pain, anorexia, nausea and abdominal discomfort, diarrhoea, head ache, muscle pain, gas

**Warning:** use caution in patients with renal impairment and history of heart disease.

**Over dosage:** weakness, increasing sleepiness, slow heart rate, cold feeling, muscle pain, shortness of breath, stomach pain, fainting, sweating, convulsions.

## 10. DAONIL

**Use:** Anti diabetic drug -- type 2 diabetes

**Side effects:** Frequency of side effects are low. Hypo glycemia, allergic skin rashes, thrombocytopenia, bone marrow depression, weight gain, weakness.

**Over dose:** dropping of sugar level, loss of coordination, loss of consciousness, confusion.

## 11. SALBUTAMOL

**Use:** to treat bronchospasms, asthma, chronic bronchitis, wheezing, shortness of breath,

**Side effects:** (rare) tremor, palpitation, head ache, allergic reactions, irregular heart beat, Chest pain, dizziness, sweating, dry mouth, insomnia, anxiety.

## 12. ATENOLOL

**Use:** to treat high blood pressure, used to treat or prevent heart attack

**Over dose:** uneven heart beat, shortness of breath, dizziness, weakness, convulsions

**Side effects:** slow or uneven heart beat, cold feeling hands and feet, loss of appetite, depression, nervousness, light headedness.

## Report of the Ruby Jubilee Celebration of the Department

The Ruby Jubilee of the department was celebrated along with a meeting of the Alumni of the department on 16/01/2010. 59 alumni with family were present on the occasion. The inaugural session which started at 10.30 am was presided over by Prof. V.J. Joseph, the former H.O.D. of the department. Rev. Fr. Luke Puthiyakunnel, former faculty of the department and former Principal of the college inaugurated the jubilee celebration by lighting the lamp.

The inaugural session was followed by the experience sharing by the alumni. A good number of alumni took part in this programme in good spirit. These moments were made very colourful by the funny events and puzzles presented by the MSc(previous) students.

The valedictory session started at 2.00 pm with Prof. Joseph George K., former principal in the chair. H.E. Archbishop Mar Mathew Moolakkattu, an alumnus of the department, delivered the benedictory address and inaugurated Prof. K.M. Mathew Astroview Centre, a monument of the Ruby Jubilee of the department and the International Year of Astronomy 2009. The Astroview centre was sponsored by the family of Prof. K.M. Mathew who was the first H.O.D. of the department and the former Principal of the college.

The Principal Prof. Babu Thomas, the former Principals Rev. Fr. Luke Puthiyakunnel, Dr. Stephen Analil, Vice Principal Dr. Francis Cyriac E., the staff secretary Dr. C.V. Thomas, the alumni Dr. Babu Kochamkunnel, Principal, PKM College of Education, Madampam and Mr. Stephen George Ex. MLA felicitated on the occasion.

The meeting acknowledged the 33 years of meritorious service of Prof. Cherian Thomas, the H.O.D. of the department. Ms Philomina Sebastian, Secretary, Alumni Association presented a memento to Prof. Cherian Thomas. This was followed by the words of response delivered by Prof. Cherian Thomas.

The meeting honoured the retired teachers of the department, Rev. Fr. Luke Puthiyakunnel and Prof. V.J. Joseph who were draped Ponnada by the Archbishop.

The meeting honoured the alumni who became the navigator of the Arch Diocese of Kottayam, Mar Mathew Moolakkattu also. Rev. Fr. Luke Puthiyakunnel handed over a gift to the Archbishop. The meeting acknowledged the alumni with academic excellence. H.E. Archbishop Mar Mathew Moolakkattu, handed over memento to Dr. Babu Kochamkunnel, Albert Thomas, Dr. Sajeev U.S., Libu K.M and Ms. Philomina Sebastian.

This was followed by the 'Nada Murikkal' function of the Astroview Centre by the Archbishop. All the guests and alumni visited the Astroview centre.

The celebration came to an end at 5.00 pm.

Co - ordinator  
John Zachariah



## Physics Association activities of the Year 2009 -10

The Physics Association activities of the year 2009 -10 was inaugurated by Pro. Philipson C. Philip of our department. He delivered a talk on History and Evolution of The Universe. It was followed by 'welcome to new comers'.

The association organized a workshop on Choice based Credit and Semester System for the I DC students. Dr. Ison V., Dept. of Physics, St. Thomas College, Pala, inaugurated the workshop. Dr. Muhammed, Dept. of Physics, Maharajas College Ernakulam, gave a talk on Measuring Instruments on the same day.

Bhouthikotsav 2009 - 10, the three day Physics Fest was celebrated during 20 - 22, October 2009. Amateur Astronomist A.K. Thankappan inaugurated the celebrations and delivered a talk on Star watching. Prof. Shaji Sebastian of our department conducted a music quiz programme on the same day. On the second day Prof. P.T. Kurian, Rtd. H.O.D. of Physics, K.E. College Manannam, took a seminar on Spintronics. An inter association quiz competition was conducted by I M.Sc. students. Prof. Celine K. Joseph memorial Inter Collegiate Physics Quiz competition & Inter collegiate Power Point Presentation competition were the highlights of the third day. Students from about 15 colleges participated in these competitions. S.B. College, Chenganacherry & St. Stephen's College Uzhavoor bagged the prizes respectively.

The association actively participated in the Ruby Jubilee celebrations of the department. A Physics Exhibition was organised by the association under the leadership of Prof. K.J. Sebastian on 20<sup>th</sup> & 21<sup>st</sup> of January 2010. Students from neighbouring schools and other departments were the beneficiaries of the programme.

Sky watching facility was provided for the public of Uzhavoor and the students both in and outside, on these nights. They were very much excited by seeing the wonders of the night sky for the first time in their life.

The quiz club and the physics Association jointly organized an inter association quiz competition on 22 /01/2010. It was conducted by the II M.Sc. students. About 14 teams participated in the competition.

The physics students actively participated in both the Onam and X'mas celebrations of the college.

The valedictory function of the association activities was conducted on 15/02/2010. Prof. Cherian Thomas presided over the meeting. Final Year B.Sc & M.Sc students were given a warm farewell.

Jipson Mathew  
Secretary, Physics Association

Reenamma Cyriac Mathew  
Staff Advisor

## **PROGRAMMES FOR THE YEAR 2010-11**

- ◆ NATIONAL SEMINAR ON RELATIVISTIC QUANTUM MECHANICS & GROUP THEORY
- “ ORIENTATION PROGRAMME ON RESTRUCTING OF BSc. CURRICULAM
- “ BHOUTHIKOTSAV - 2010
  - o Prof. CELINE K. JOSEPH MEMORIAL INTER-COLLEGIATE PHYSICS QUIZ COMPETITION
  - o INTER-ASSOCIATION QUIZ COMPETITION
  - o POWER POINT PRESENTATION COMPETITION
  - MUSIC QUIZ COMPETITION
- “ A SERIES OF STAR WATCHING NIGHTS
- “ ALUMNI MEETING
- “ SMART CLASS ROOMS

### **NOBEL PRIZE IN PHYSICS 2009**

Nobel prize in physics 2009 has been awarded to

1. **Charles K. Kao, Stanard Telecommunication laboratories, UK.**

**For groundbreaking achievements concerning the transmission of light in fibers for optical communication”**

2. **Willard S. Boyle, BELL laboratories, Murray Hill, NJ, USA.**

3. **George E. Smith, BELL laboratories, Murray Hill, NJ, USA.**

**for the invention of an imaging semiconductor circuit – the CCD sensor**

# Contributions from Alumni

1.	Pius Lukose	Rs. 5000/-
2.	Sreekanth M. Nair	Rs. 2500/-
3.	A.Y. Regi	Rs. 10000/-
4.	Princemon Francis	Rs. 10000/-
5.	Rajesh P.S.	Rs. 6860/-
6.	Biju Skariah	Rs. 10000/-
7.	Shinoy Kurian	Rs. 8000/-
8.	Raji Stephen	Rs. 2500/-

**Total**

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**Rs. 53000/-**

# Contributions from Former Faculty

1.	James Mathew	Rs. 5000/-
2.	Johny M.C.	Rs. 4595/-
3.	C.U. Mary	Rs. 10000/-
4.	Family of Prof. K.M. Mathew	Rs. 60000/-

**Total**

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**Rs. 75595/-**