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COMSATS PHYSICS TODAY

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INSIDE THIS ISSUE

Editor's Note

"There are two ways to live your life. One is as though nothing is a miracle. The other is as though everything is a miracle."

(Albert Einstein, 1879-1955)

And so, perhaps, the ultimate quest of scientists, and of humanity at large, is to seek to believe that nothing is a miracle. The essential problem with miracles, besides the sheer lack of human power over them, is their unpredictability. Naturally then, human beings aspire to extend more control over nature, to be able to manipulate it or at least to fight its calamitous perpetrations, and thus to attenuate this shell of unpredictability surrounding their lives if not to break out of it. The last few centuries have witnessed mankind taking huge steps towards the fulfillment of this quest of his. Hence, what are everyday tools and applications of science, be that in medicine or in engineering, to a modern human, would be nothing less than miracles to a born-again homo sapiens from the millennia past.

At the Department of Physics, CIIT Lahore, we are working hard on bringing our revered institute at par with the best in the world. We aim to join the curious minds the world over on the above quest that defines this mightiest creation of the Almighty. With this issue of COMSATS Physics today, we give you a glimpse of some small steps we took in this direction, that will one day, hopefully, add up into one giant leap for mankind.

Shoaib

FACULTY PROFILES

New Faculty

Dr. Mazhar Hussain
Designation: Assistant Professor
Qualification: PhD (GCU, Lahore)
Research area: Nuclear Physics
Date of joining: September, 2010

Mr. Naveed Aslam
Designation: lecturer
Qualification: PhD expected in June, 2011 (GCU Lahore)
Research area: Nuclear Physics
Date of joining: September, 2010

Resumption

Dr. Shoaib Munir (Assistant Professor) joined back the department after successful completion of his postdoctoral research at the Institute of Physics, National Autonomous University of Mexico (UNAM), Mexico. He obtained his PhD from the University of Southampton, UK, in June, 2007, and his field of specialization is Theoretical Particle Physics. Since then he has been a faculty member of the Department of Physics, CIIT Lahore. His two -year postdoctoral position was funded by DGAPA (directorate for science funding), UNAM, and it commenced in August, 2008.

FACULTY PROFILES

An Interview with Dr. Shoaib Munir (Assistant Professor of Physics at CIIT Lahore)

Conducted by Anam Ramzan (BS student, Batch-5)

Date of Birth.

October 5, 1979.

Siblings and your number.

I am the youngest of four siblings.

Qualifications.

Matric from Pakistani school, Abu Dhabi (U.A.E.), F.Sc. from Scholars College Lahore, B.Sc. and M.Sc. from GCU Lahore and PhD from the University of Southampton, UK.

How did you pick your current profession?

I have found physics very fascinating since my days in the higher secondary school. The interest kept increasing as the years passed, until I decided to take it up as a career.

Are you teaching by passion or just by profession?

Physics is my passion and teaching helps me spread my knowledge and passion. At the same time I also learn more myself and thus improve as a researcher. So both teaching and research go hand in hand.

Your lifestyle.

I am choosy about what I wear but fairly simple when it comes to food. I am irritated by disorder around me.

Any phobia you ever had or still are having.

As a child I was afraid of darkness, it's called nyctophobia. But I guess I have grown up, and now it's just the phobia of letting my life go wasted.

Three things that are always with you wherever you go.

My laptop, a book and, of course, my mobile phone.

Religious or spiritual?

Religious.

You always Love to read.

Global literature.

The best compliment you ever received.

I recently delivered a seminar related to my research at NCP, Islamabad. People received it very well and their comments were very uplifting. I think for a researcher there cannot be a bigger compliment.

The worst criticism ever received by you.

Sometimes people think of me as a snob, but I am not like that at all.

The first thing you noticed whenever you talk to a person, male or female.

Personality and maturity.

When would you get married? Will your family choose your spouse?

This year hopefully. My family will not have to undertake the arduous task of choosing a spouse for me; I'll do it myself.

Favorite movie. Favorite actor and actress.

The Matrix, Braveheart. Morgan Freeman and Meryl Streep.

If you were given a choice to live in another country, which one would it be?

Spain.

Favorite poet? Favorite stanza/poem.

Ghalib and Faiz. I particularly like Ghalib's ghazal starting with 'Bazeecha-e-atfal' and Faiz's poem titled 'Meray dil meray musafir'.

Fame, dignity, wealth; what'd be your first pick?

Dignity.

What would you be if you were not a teacher?

You mean if I were not a physicist? - A sociologist or may be a philosopher.

Keeping aside your real age, you think of yourself as a boy of...

As a man of 45.

Point of view about politics and politicians.

I hate to discuss politics. It's a dirty game here in our country.

Three things that best explain Shoaib Munir.

Steadfast, professional, curious.

Favorite singer / song.

Depends on my mood basically. I listen to all types of English and Urdu music. But nowadays I listen a lot to the English band Keane and to Rahat Fateh Ali Khan.

The batch that you enjoyed teaching the most to date at CIIT.

I haven't taught many yet.

Most memorable moment in your life.

When I obtained my PhD degree.

Ideal personality.

There are quite a few, but I guess Leonardo da Vinci inspires me the most.

You are least concerned about.

People's opinion of me.

One thing you want to change in you department.

I'd like people here to be a bit more professional.

Where do you see yourself after 10 years?

As an established physicist.

You always love to talk about...

Physics. Ideas. Cars.

People you like or dislike.

I dislike opportunists and like sincere people.

Any massage for your colleagues here.

Instead of merely complaining about what you haven't got, try to get the maximum out of what you have got.

Your best mate in CIIT.

I like to sit and discuss with Mr. Noman A. Khan.

Massage for students.

Please take yourself, your education and your future seriously. Get passionate about your chosen career path and work hard on it

GOINGS ON

A Welcome Party In Honor Of Dr. M. A. Bodla (Director CIIT Lahore)

On October 8, 2010, the Department of Physics arranged a lunch party in honor of Dr. M. A. Bodla (Director, CIIT Lahore) and his wife Dr. Talat Afza (Director Academics, CIIT), to congratulate him on his appointment as the new director. The lunch was arranged in Cafe Mehak opposite the main entrance of CIIT Lahore campus. The worthy guests arrived at the venue at 4.30 p.m. and were warmly received by the department's faculty members. The party started with a word of thanks from Dr. Javed Iqbal (former HoD Physics) to the Director for gracing the party with his presence.

Dr. Bodla shared his views on the ethical strength that one must bear as a professional. Many departmental matters came under discussion which the worthy director addressed in a very polite manner. He proposed some action plans for the improvement of the department. He also advised the faculty to extend full cooperation towards each other so that the department could emerge as a strong entity and a centre of high standard education.

While this informal session was going on, everyone enjoyed a delicious lunch. It is worth mentioning that a beautiful front view of the campus shone through the window of the dining hall which enhanced the pleasantness of the environment and made everyone marvel at the splendor of the architecture of the campus.

CONFERENCES & SEMINARS

Dr. Mohammad Asif participated in the 'Ist International UV & EB Industry Development Forum', held on October 23-26, 2010, at Howard Johnson Garden Plaza Yixing, Yixing, People's Republic of China.

Dr. Mazhar Hussain attended the '9th Shaukat Khanum Memorial Cancer Symposium', November 26-28, 2010, at Pearl continental hotel, Lahore. He presented a talk titled "STUDY OF EXCITATION FUNCTIONS AND EVALUATIONS OF CHARGED PARTICLE DATA FOR PRODUCTION OF THE THERAPEUTIC RADIONUCLIDES ^{186}Re". The abstract of the talk is as follows:

"With the discovery of radioactivity, the emitted radiation, e.g. α, β, and γ rays, started playing a key role in many fields including life sciences. Today most of the radionuclides are produced artificially, and radioactivity has revolutionized life sciences during the last century. Now nuclear medicine is a well-established and significant branch of medical sciences. Nuclear medicine can be divided presently in two main branches. The largest and most common type involves diagnostic procedures in which a radionuclide in a chemically suitable form is administered to the patient and the distribution of the radioactivity in the body is determined by an external radiation detector. The results are in the form of image of the involved organ. The second branch of nuclear medicine deals with the radiation therapy that is the ultimate aim of all diagnostic investigations. Here the tissues or organs are treated with radiation and restored to the normal functions in the human body. The objective of this study is to evaluate an emerging therapeutic radionuclide, ^{186}Re".

Dr. Shoaib Munir attended the '3rd winter meeting on particles and fields', held at the National Center for Physics, Islamabad, Pakistan, on December 28-31, 2010, and presented a talk titled 'Z' BOSONS AT THE TEVATRON'. The abstract of his talk is as follows:

"We revisit the CDF analysis for Z' bosons occurring in certain phenomenologically important E6 GUT-based models using the data collected in the di-muon channel, and extend its scope to a number of other models by adopting a general parameterization which treats all of them on an equal footing. We also suggest a Bayesian statistical method for finding the exclusion limits on Z' mass, which allows one to explore a wide range of the Z' coupling parameter, g', and to take into account the effects of interference of Z' bosons with the SM neutral gauge bosons. The limits obtained using this method differ by the corresponding CDF ones by a few tens of GeVs in some cases".

AWARDS & VISITS

It is a great honor for CIIT Lahore that Dr. Abdul Rashid has been awarded a research grant of Rs. 7.5 million by HEC, Pakistan, for the project titled 'Fabrication of Micro-lenses and Nano-particles by Laser Induced Forward Transfer Technique'. This grant will be used in the establishment of a state-of-the-art nanoscience laboratory at the Department of Physics, CIIT Lahore, and will play a very crucial role in laying the foundations of a world-class physics research facility in Pakistan.

Dr. Abdul Rashid also made a month long visit to the University of Johannes Kepler in Linz, Austria, for carrying out research in the field of nanophysics with Professor Dr. K. Piglmayer. The research work he carried out there will lead to publications in international scientific journals, and his visit has enhanced collaborative efforts between CIIT and JKU in nanophysics research.

Dr. Muhammad Ashfaq Ahmed, along with the MS physics, batch-II, students, visited LUMS School of Science and Engineering (SSE), Lahore, between November 30 and December 02, 2010, to attend a 2-lecture series on LASER delivered by Dr. Sabieh Anwer, Assistant Professor, LUMS. The lecture series was organized by the Khwarzimic Science Society in order to celebrate 50 years of the invention of LASER. The CIIT Lahore team also visited the undergraduate and graduate laboratories at SSE that have been established under the expert supervision of Dr. Sabieh Anwer.

Dr. Salman Naeem Khan and Dr. Muhammad Ashfaq Ahmad visited the Islamabad campus of CIIT to meet Dr. Arshad Saleem Bhatti (Dean of Sciences, CIIT, and Ex-Chairman, Department of Physics, CIIT) in fall 2010, and discussed prospects of research collaboration between the two campuses of CIIT. They also visited Smart PCB (Printed Circuit Board) Ltd., Islamabad, and checked their PCB fabrication facilities. They then performed some measurements at the PCB fabrication installations of the National University of Science and Technology (NUST), Islamabad. A number of publications based on these experimental results are pipelined.

PUBLICATIONS

S. J. Iqbal and S. A. Miratashi, '*Using ANFIS system for speed regulation in 'Linear Inductive Actuators'*, World Applied Sciences Journal, Vol. 9 (10), pp. 1158-1163, 2010.

Qinghong Liao, Guangyu Fang, Muhammad Ashfaq Ahmad and Shutian Liu, '*Sudden birth of entanglement between two atoms successively passing a thermal cavity*', Optiks Communication, Vol. 284, pp. 301-305, 2011.

RESEARCH CORNER

Radioisotopes

By Dr. Mazhar Hussain

Radioisotopes play a vital role in life science. Artificially produced radionuclides are important for energy applications as well as for nuclear medicine. They can serve for the diagnostic techniques and for the radiotherapy. In this brief article I would summarize only one area of nuclear medicine i.e. radiotherapy [1] . Interest in using radioactive isotopes for therapeutic applications is increasing because of favorable clinical results. The main indications for use of radiotherapeuticals are in oncology and rheumatology. Radiotherapy can generally be classified as:

External photon beam therapy:

More than 80% of the cancer patients within industrialized countries are treated with radiation as part of their medical treatment. This percentage is lower in developing countries but there is strong evidence of an increase in some of them. External irradiation with photon beams delivered by linear accelerators, with energies from a few MeV up to about 20 MeV, is the present reference for radiation therapy modality. Fractionated irradiations over 4-6 weeks are applied. The benefit of any new technique should be evaluated by comparison with this reference therapy.

Brachytherapy (Curietherapy):

In this type of therapy, sealed sources are mostly used, including intracavitary and interstitial therapy. Intracavitary therapy takes advantage of natural cavities in the body to insert radioactive material, and deliver high doses to the "tumour" (target volume) while sparing the surrounding normal tissues. The availability of high specific activity radioisotopes allows the design and production of sources of small size and is a major advantage in achieving high dose rates. Interstitial therapy implies the insertion of radioactive sources inside the target volume. ^{192}Ir wires are used, and ^{103}Pd and ^{125}I seeds have also been introduced for the treatment of cancer of the prostate (as permanent implants) [2].

Metabolic therapy:

Administration of sodium iodide (^{131}I) is a good example of the most efficient metabolic therapy due to high specific incorporation of iodide in the thyroid tissue. Bone seekers, such as ^{89}Sr, and, ^{186}Re and ^{153}Sm (attached with suitable carrier) have been shown to be efficient for pain palliation in bone metastases.

Administration in cavities:

^{32}P colloids are very useful to treat some forms of arthritis, metastatic effusions, and so forth. In addition, complexes of ^{90}Y, ^{186}Re, ^{188}Re and ^{169}Er are routinely used in several countries for the treatment of very painful synovial joint inflammation and can improve the quality of life of the patient.

Radioimmunotherapy (RIT):

RIT is the administration of radioisotopes chemically conjugated to antibodies or antibody-derived constructions such as small peptides. The antibodies can recognize and bind to antigen(s) of the tumour cells, serving as direct carriers for the radionuclide [3]. RIT is a more challenging approach in therapy than in diagnosis because

(1) higher activities are used (normal tissue toxicity),
(2) non-uniform distribution of the radionuclide results in non-uniform dose distribution,
(3) difficulty to deliver sufficient doses to the tumour cells, and
(4) problems with the chemical stability of the radiolabeled compound.

Radionuclides for internal therapy

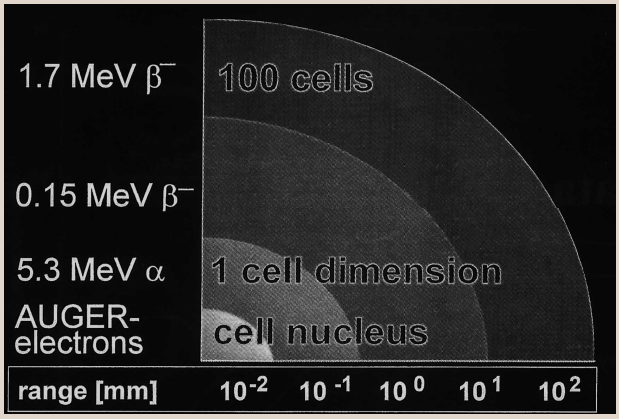
Radionuclide therapy is unique in a sense that this treatment modality is an alternative for radiation therapy and chemotherapy; it can deliver radiation doses in the target tissues selectively. Due to non-invasive and systemic nature, long term and immediate side effects are minute [3]. As mentioned above, some radionuclides are used internally to achieve the therapeutic effect to treat a certain disease.
Different multidisciplinary therapeutic strategies and technical approaches are used today in cancer therapy. Radionuclides emitting low-range highly ionising radiation (b^- and a-particles, Auger and conversion electrons) have been gaining considerable significance in internal radiotherapy [4].

Criteria of choice of a therapeutic radionuclide

The major criteria for the choice of a radionuclide for endotherapeutic use are suitable decay characteristics and suitable biochemical reactivity. Concerning the decay properties, the desired half-life is between 6 hours and 7 days and the emitted corpuscular radiation should have a suitable linear energy transfer (LET) value and range in the tissue [cf. 5,6]. The ratio of non-penetrating to penetrating radiation should be high. The daughter should be short-lived or stable. The stability of the therapeutical is demanded over a much longer period than that in the case of a diagnostic pharmaceutical. The basis for successful endoradiotherapy thus incorporates:

a) Good and selective concentration and prolonged retention of the radiotherapeutical in the tumor, and
b) Minimum uptake in normal tissue.

As a result of the above mentioned criteria, the choice falls on about 30 radionuclides. Most of them are β^- emitters but several of them are α- emitters and Auger electron emitters. In principle, to achieve the desired therapeutic effect, a particular radionuclide should exhibit adequate physical, chemical and biological properties.
The Auger electrons have a range of about 10 μm and can have a therapy effect only if they reach the cell nucleus, e.g. by bringing the radioactive source atom to the DNA. The α-particles, on the other hand, have a range of about 100 μm and can have a therapy effect already if they reach the cell membrane, e.g. by attachment of the α-emitter to a receptor ligand. The β^--particles have ranges of about 1 mm and more, depending upon their energies. They can thus have a therapeutic effect over a wide range but the effect is non-specific and rather diffused.
The most commonly used radionuclides ^{131}I and ^{90}Y are beta emitters. There is no need to target every individual cell with these radioisotopes because the mean radiation range is 0.4-2.5 mm (i.e., "cross fire" can effectively kill 10 nearby cells). Because of lower β^- energies ^{177}Lu, ^{153}Sm and ^{67}Cu are promising alternatives, and are being evaluated for clinical trials.



Correlation between type and energy of corpuscular radiation and its range in tissue.

Alpha emitters deliver very high-LET radiation over a range of 50-90 micrometers. Specific attachment to or incorporation into a cancer cell is essential for successful application and is indicated mainly for microscopic/subclinical disease. ^{213}Bi and ^{211}At are examples of alpha emitters used in clinical trials [7,8].

Auger-electron emitters such as ^{125}I provide short-range (nanometer), densely ionizing radiation from the resulting electron "cascade" phenomenon. This decay process is specifically efficient when incorporated into DNA strands.

Concluding remarks:

In conclusion, there is a wide range of radionuclides in use or being proposed for therapeutic applications. The issue is to evaluate the nuclear data for the production of these nuclides at the appropriate specific activity and purity levels, as well as the relevant decay data, are adequate for safe and efficient medical applications [9,10].

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STUDENTS' CORNER

Role Of Students Towards Change in Pakistan

By Imtiaz Ali (BS student, Batch-4)

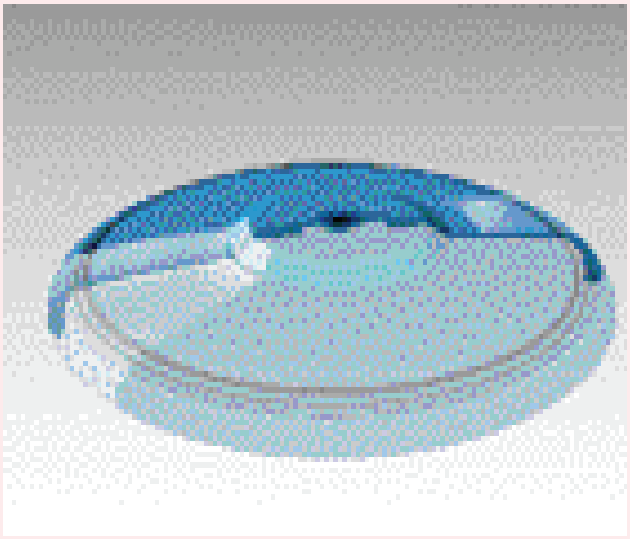
"Destiny of a nation is in the hands of its students."

In order to bring a positive change in the Pakistani society, it is the need of the hour that our students not only focus on their studies but also fulfill their other responsibilities towards the nation. Students in a developing country like ours can and should work for social and national progress. Our students, especially those in colleges and universities, can educate the uneducated (illiterate) masses. They can engage in a universal educational program for children and adults alike, sponsored by the government or rich industrialists, businessmen and landlords, in schools, colleges, suitable government buildings or other specially erected structures, in open places and even in parks, gardens and fields. The students should teach not just to earn money but more to serve their dear nation and country. They should understand clearly that unless most or all of our people get educated, we cannot join the league of advanced and developed nations of the world.

Students must love their country as they love their parents and religion. In other words, every student should be a patriot. Students, after having been equipped with education, must offer their services to their nation which gave them shelter, identity and honor. Students can take part in social welfare activities for general social progress. A wing of the social welfare department may advise the different categories of our students about how they can contribute in their respective fields. The people should be made to feel that in business, politics and in private and public dealings, honesty brings real success. Junior students of high schools and colleges can engage in physical welfare work like road repairs and general cleanliness of parks and grounds. The senior students can assist the law enforcing agencies in their work. For example, they can make reports to price controlling agencies about the high prices charged by shopkeepers. They can bring cases of corruption in government offices to the notice of the anti-corruption department. They can help the police in their action against anti-state elements, like drug addicts, criminals and smugglers. It is high time for the government, social organizations and students to work in close co-operation for the advancement of the country.

In most of the developing countries, young people are growing up without opportunities, information and services they need to work to their full potential. In my opinion, in this moment the youth of Pakistan is in a far better position than many of their peers in other countries because of the demographic advantages they enjoy in Pakistan. We have to prepare ourselves to face the challenges of the time with unshakable courage and youthful confidence. There is no doubt that the youth of the nation has to play a key role in bringing about socio-economic and sociopolitical changes in Pakistan, much like everywhere else, as youth is indeed the most productive and energetic period of life.

PHYSICS OF SPORTS



Contributed by Asqd Feroze (BS student, Batch-5)

What makes a frisbee fly in a stable position in the air?

The dynamics of motion of a frisbee are easily explained by the laws of physics. The rounded edge of a frisbee looks like the front edge of an aircraft wing. The curved upper surface of the wing provides lift to the aircraft. Similarly the curved upper surface of the frisbee presses the air upwards creating a low pressure region on the upper side of the frisbee while there is a high pressure region below it. This pressure difference gives lift to the frisbee. It remains stable during the flight due to its spinning motion. As the law of conservation of angular momentum says that the angular momentum of a spinning body remains constant without the influence of the external force applied against the spinning motion of the frisbee. The air causes resistance to the spinning as well as the forward motion of a frisbee and eventually brings it to rest. Indeed if we try to throw the frisbee without spinning it, it will wobble and tumble.

What makes a cricket ball swing?

When given the new ball at the start of an innings, the fast bowlers generally use the raised seam of the ball to create swing. This creates the following effect as the ball traverses the air; the side with the seam represents a rough surface that causes the air flowing over it to become turbulent, whereas the air flows smoothly over the other side of the ball with the smooth surface. Turbulent air is at a lower pressure than smooth flowing air, causing a pressure difference on the ball, which creates a side force resulting in the ball moving sideways.
Reverse swing generally tends to occur later in the game when the ball is older and has somewhat deteriorated. This effect is usually only significant at very high speeds. However, it can also occur at lower speeds if the ball is considerably roughened. At high enough bowling speeds and as the ball becomes rougher, it swings in the direction opposite to the alignment of the seam. Hence the use of the term 'reverse', implying swinging of the ball non-conventionally.

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