Address by Mr. Sarayu Roy,

Deputy Chairman, Planning Board , Jharkhand

Shri Inder Singh Namdhari, Honourable Speaker, Jharkhand Assembly, Dr.Loic Villain, Paris 7 University, France, Prof. S. K. Mukherjee, Vice Chancellor, BIT, Mrs. Mridula Sinha, Secretary, DST, Government of Jharkhand, Dr. P. K. Barhai, Dean, Spronsored Research, BIT, distinguished Professors of the institute, members of the press and media, students from BIT and other schools and colleges of Jharkhand, teachers and lecturers from participating schools, colleges and universities, ladies and gentlemen.

It is indeed a great honor bestowed on me in becoming a part of a global Celebration of the **World Year of Physics-2005** at the Birla Institute of Technology. I feel extremely happy to see that BIT in collaboration with DST, Jharkhand, are in the forefront of this celebration in the state of Jharkhand. Infact, being a post graduate in physics, when I received the invitation from this esteemed institution, I immediately agreed joyfully despite having my otherwise busy daily engagements.

The year 2005 marks the 100th anniversary of Albert Einstein's "**miraculous year**" in which he published three important papers describing ideas that have since influenced all of modern physics. This year provides the opportunity to celebrate **Einstein,** his great ideas, and his influence on life in the 21st century. The **World Year of Physics 2005** is a United Nations endorsed, international celebration of physics. Events throughout the year will highlight the vitality of physics and its importance in the coming millennium, and will commemorate the pioneering contributions of Albert Einstein in 1905.

In the year 1905, the famous physicist **Albert Einstein** wrote three seminal works in different areas of physics, all of which set the foundations to modern physics: (i)The special theory of relativity, (ii)Photoelectric effect and (iii)Brownian motion. The year 2005 was chosen as the World Year of Physics exactly one century later as a tribute to Albert Einstein and his contributions to physics through the efforts of a worldwide collaboration of scientific societies, the World Year of Physics brings the excitement of physics to the public and will inspire a new generation of scientists.

Mirabilis

The year 2005 is significant primarily because of the changes that have occurred in the philosophy of physics over the past 100 years. These changes began in 1905 with the publication of three papers by Einstein that explained Brownian motion, introduced the special theory of relativity, and described how the photoelectric effect could be explained by the quantization of light, which helped to launch quantum mechanics. These papers are commonly called his Annus Mirabilis Papers because they later defined 1905 as a ***miracle year*** for

physics. What makes these papers remarkable is that, in each case, Einstein boldly took an idea from theoretical physics to its logical consequences and managed to explain experimental results that had baffled scientists for decades.

Photoelectric effect

The first paper proposed the idea of "energy quanta" and showed how it could be used to explain such phenomena as the photoelectric effect. The idea of energy quanta was motivated by Max Planck's earlier derivation of the law of black-body radiation by assuming that luminous energy could only be absorbed or emitted in discrete amounts, called *quanta*. Einstein showed that, by assuming that light actually *consisted* of discrete packets, he could explain the mysterious photoelectric effect.

The idea of light quanta contradicted the wave theory of light that followed naturally from James Clerk Maxwell's equations for electromagnetic behavior and, more generally, the assumption of infinite divisibility of energy in physical systems. Even after experiments showed that Einstein's equations for the photoelectric effect were accurate, his explanation was not universally accepted. However, by 1921, when he was awarded the Nobel Prize and his work on photoelectricity was mentioned by name in the award citation, most physicists thought that light quanta were possible. A complete picture of the photoelectric effect was only obtained after the maturity of quantum mechanics.

Brownian motion

His second article that year delineated a stochastic model of Brownian motion. Brownian motion generates expressions for the root mean square displacement of particles. Using the then-controversial kinetic theory of fluids, it established that the phenomenon, which still lacked a satisfactory explanation decades after it was first observed, provided empirical evidence for the reality of atoms. It also lent credence to statistical mechanics, which was also controversial at the time.

Before this paper, atoms were recognized as a useful concept, but physicists and chemists hotly debated whether atoms were real entities. Einstein's statistical discussion of atomic behavior gave experimentalists a way to count atoms by looking through an ordinary microscope. Wilhelm Ostwald, one of the leaders of the anti-atom school, later told Arnold Sommerfeld that he had been converted to a belief in atoms by Einstein's complete explanation of Brownian motion.

Special relativity

Einstein's third paper that year was a highly self-contained work, hardly making reference to other works which may have led to its development. This paper

introduced a theory of time, distance, mass and energy which was consistent with electromagnetism, but omitted the force of gravity.

Special relativity avoids the problem in science that was present after the Michelson-Morley experiment failed to measure a speed difference between perpendicular light beams, by postulating that the speed of light is *not* relative to some medium and is the same for all observers irrespective of their relative velocities. This is unlike all other known waves, which require a medium (such as water or air) to propagate.

Einstein's explanation arises from two postulates: The first is Galileo's idea that the laws of nature are the same for all observers that move with constant velocity relative to each other. The second was that the speed of light is the same for every observer.

Special relativity has several striking consequences, because the concepts of absolute time and space are incompatible with an absolute speed of light. The theory abounds with paradoxes and appeared to make little sense, landing Einstein substantial ridicule, but he eventually managed to work out the apparent contradictions and solve the problems.

Consequences

Einstein's special theory of relativity heralded a new kind of physics, one that digressed from the classical mechanics that had been derived from Newton's calculus. Although his 1905 paper on the photoelectric effect helped spur the development of quantum mechanics, Einstein himself considered quantum theory, which introduced the concept of uncertainty into the laws of the physical world, incomplete. His deterministic view is illustrated in the famous quote "I am convinced that He (God) does not play dice." Einstein viewed quantum mechanics as a means simply to the end of a unified field theory, which would unite the disparate theories of quantum field theory, general relativity, and electromagnetism. However, he never denied that quantum mechanics was very successful in explaining and predicting physical phenomena.

The quest for a unified field theory is continuing with work into quantum mechanics, string theory, and superconductivity. The year recognizes the fundamental shift in natural philosophy from a theory of the absolute to that of the uncertainty and relativity spurred by Einstein's 1905 work.

The general public's awareness of physics and its importance in our daily life is decreasing. The number of physics students has declined dramatically. Action must be taken by the international physics community to share its visions and convictions about physics with politicians and the public at large. Physics not only plays an important role in the development of science and technology, but

also has a tremendous impact on our society. Although this may be evident to physicists, it is not necessarily the case for everyone.

In the last few years, there has been a large retreat in the public's awareness of physics and its importance. We have to enhance the awareness of physics, especially since though the interest in physics is declining, the importance of physics and it's impact on everyday life is significantly increasing. Physics has been the basis for understanding the physical world and nature as a whole. The applications of physics are the basis for much of today's technology. Physics plays an important role in many aspects of life including increasing energy sources, solving ecological problems and many innovative developments in modern medicine and biomedical technologies.

At the dawn of the 21st century the contributions of physics to other sciences will be essential to solving global problems such as energy production, nanotechnology, discovery of new materials, environmental protection and public health. Human civilization has reached a cross road where in one side we have tremendous advancement in terms of development in information technology, global connectivity, availability of food, new drugs and medical procedures, faster mode of transport, availability of clothes in affordable prices and many more, on the other hand a tremendous uncertainty exists "What will happen after 30 – 40 years from now when fossil fuel reserves of this planet will be exhausted"?. A very big uncertainty indeed, because without energy resources modern civilization will enter in the dark age. What is the remedy? Only principles of Physics have the solutions and Physicists of future generation have to find out the solution and rescue the planet from entering in the Dark Age. Physicists throughout the world have been already working on a possible solution, i.e., the production of energy through nuclear fusion reaction using **Deutron-Tretium plasma.** In Europe a US 10 Billion Dollar joint European programme is going to start in France from next year in which China and Japan are also participating. Negotiation with Indian Government is in advance stage for Indian participation in this global programme for plasma fusion research. Thus, I hope, physics will continue to play prime role in shaping the future of world and modern society.

Organizing a WYP 2005 event benefits you, your organization, and, more generally, your community. A WYP event can increase the profile of your organization, build relationships within your community, attract new avenues of funding and support, improve the communication skills of your staff and volunteers, and, perhaps most importantly, inspire the next generation of scientists. I hope WYP-2005 will enhance the awareness of general public about the role of physics in modern technology driven society.