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### Student's Question of the Day

**How electricity can be produced by nuclear fusion?**

- **Nuclear fusion**

Fusion is the energy source of the sun and the stars. On earth, fusion research is aimed at demonstrating that this energy source can be used to produce electricity in a safe and environmentally benign way, with abundant fuel resources, to meet the needs of a growing world population. In a fusion reaction, two light atomic nuclei fuse together to form heavier ones, as is shown in the figure. The fusion process releases a large amount of energy, which is the energy source of the sun and the stars. Fusion has some key features which make it an attractive option in a future energy mix: the fusion process is inherently safe; waste which will not be a burden for future generations; no emission of greenhouse gases; and the capacity for large scale energy production.

- **Fusion power**

The energy demand of the world is growing due to the increase in world population and the increasing energy (and especially electricity) use per capita.

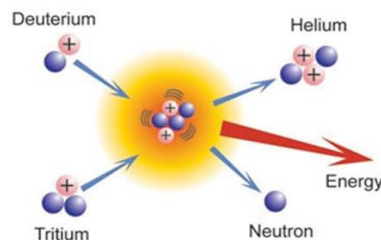


Figure: Two nuclei of deuterium and tritium fuse together to form helium, a neutron, and a large amount of energy

Our present energy system relies heavily on fossil fuels, which supply 80% of the world energy demand. In order to curb the well known problems related to our present energy system, such as climate change and security of supply, we need to move to a sustainable energy mix.

- **Advantages of fusion energy**

First of all, fusion is an almost limitless fuel supply. The basic fuels are distributed widely around the globe. Deuterium is abundant and can be extracted easily from sea water. Lithium, from which tritium can be produced is a readily available light metal in the Earth's crust. Fusion produces no greenhouse gas emissions. Fusion power plants will not generate gases such as carbon dioxide that cause global warming and climate change, nor other gases that have damaging effects on the environment. Fusion is suitable for the large-scale electricity production required for the increasing energy needs of large cities. A single fusion power station could generate electricity for two million households. Waste from fusion will not be a long-term burden on future generations. Only metal parts close to the fusion plasma will become radioactive. Any radioactive waste generated will be small in volume and the radioactivity will decay over several decades with the possibility of reuse after about 100 years. No transport of radioactive materials is required in the day-to-day operation of a fusion power station, as the intermediate fuel tritium is produced and consumed within the power plant. The fusion reaction is inherently safe. Only about two grams of fuel present in the plasma vessel is enough for a few seconds of "burn". As fusion is not a chain reaction, the reaction can never run out of hand.

**Dr. Muhammad Asif**

*(Assistant Professor, Physics, CIIT Lahore)*

## **New Research**

### **Simple temperature change creates spin current**

A group of Physicists in Japan have discovered a new way to create spin-polarized currents of electrons by simply heating one end of a magnetic sheet. The team was able to flow spin current in the sheet of 6 mm, which is about 10,000 times more than spin current flow in ordinary copper wire. The team believes that the phenomena (spin Seebeck effect) could help to overcome technological barriers preventing the creation of practical spintronic devices, which use both the spin and charge of electrons to process information.

Nature 455, 778-781, 2008

### **Not wonder, this is Physics**

An atomic clock kept at the National Bureau of Standards in Boulder, Colorado, U.S.A., (1650 meters above sea level), gains about five microseconds each year relative to an identical clock kept at the Royal Greenwich Observatory (25 meters above sea level). The reason is that gravity gets stronger as one gets closer to the Earth's core, and, according to Einstein's Theory of Relativity, time is slower in stronger gravitational fields.

## **News Bulletin**

1. It is a matter of great honor for CIIT, Lahore and department of physics that the names and profiles of Dr. Ashfaq Ahmad (HOD Department of physics) and Dr. Muhammad Asif (Assistant Professor) are going to be



lished in the 26th edition (November 2008) of Who's who in the world. This is indeed a great distinction for both of them and the CIIT Lahore. Heartiest congratulations to both for this wonderful achievement.

2. We would like to share another achievement of Dr. Ashfaq Ahmad (HOD Department of physics) that his name has been included in the world directory of crystallographers. Many congratulations to him and best wishes for even more prosperous future.
3. Mr. Kaleem Ullah has rejoined Department of Physics as Lecture on 06.10.2008. He has been playing active role for the development of new apparatuses under the directions of research and development cell.
4. A research paper by Dr. Abdul Rashid titled, "Photo thermal CVD of carbon thin films using  $\text{CH}_2\text{I}_2$  precursors", has been published in journal Chemical Vapor Deposition, Vol.14, 279-285, 2008.
5. A research paper by Dr. Salman Naeem Khan titled, "Small sized Sierpinski carpet fractal patch antenna for dual band 2.4/5.5GHz WLAN applications", has been accepted in Journal of Microwave and Optical technology letters, Vol. 22, 1883-1888, 2008.
6. A research paper by Dr. Muhammad Ashfaq Ahmad titled, "Image sharing scheme based on combination theory", has been accepted in Journal of Optics Communications, Vol. 281(21), 5322-5325, 2008.
7. The Department of physics has prepared "Boyle's Law Apparatus" under the kind guidance of The worthy Director and Dr.

Ashfaq Ahmad (HOD Physics Department). The apparatus is ready for use in undergraduate BS Lab.1. The cost of indigenously made equipment is cheap but unit available in the market is very expensive.

8. Extra classes have been arranged for all batches of physics in which all faculty members interact with the students to improve their basic skills of physics. Dr. Afaq Ahmad is the incharge.

### **Acknowledgement:**

The editors thank Dr. S. N. Khan for help in designing the template.