

Contents

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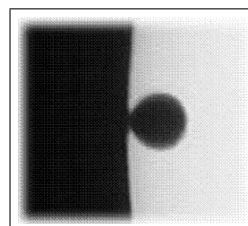
Commentary	4
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Cover Article

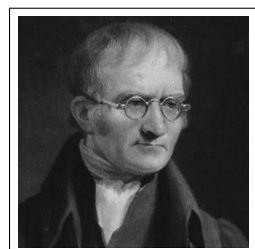
The Transit of Venus 2012— A Celestial Spectacle

Soumitro Banerjee 7

On the 6th of June, 2012, there will be a spectacular scene in the sky: The planet Venus will be seen passing over the disk of the sun. What is the historical significance of this event? What is the science behind it? How to view the event? From where can it be observed, and when? Prof. Banerjee throws light on these issues.



General Articles



Evolution of Chemistry—Part II

K. P. Saji 19

This year is being celebrated as the “International Year of Chemistry.” On this occasion we publish a serialized article on the evolution of chemistry through the ages. In the Part-I, the development of chemistry from the ancient times till Lavoisier was discussed. In the next instalment, the author discusses the “modern” phase of chemistry, starting from Dalton up to the birth of quantum mechanics.

E-Waste and Its Management: an Emerging Problem

Abhijit Mitra 29

With the ever increasing use of consumer electronic goods by the people, the problem of electronic waste is fast becoming an important problem faced by the society. Dr. Mitra discusses the dimensions of the problem and the possible solutions.

Galileo’s experiment on falling objects

George Joseph 36

Organizational News

Report of the activities of the Breakthrough Science Society:

□ Tamil Nadu	37	□ Kerala	37
□ Andhra Pradesh	38	□ West Bengal	39
□ Jharkhand	40	□ Bihar, Uttar Pradesh, Karnataka	41

Science News & Commentaries

The people's movement in Koodankulam

THE PROPOSAL for installing two nuclear power plants of 1000 MW capacity each at Koodankulam in Tirunelveli district of Tamilnadu was made in the late eighties. An Inter-Governmental agreement on the project was signed on November 20, 1988 between India and the former USSR. After the breakup of Soviet Union, the project remained uncertain. The project was revived by signing a new agreement between the governments of Russia and India in 1997 and the construction work started.

The reactors are of VVER-1000 model. They are water-cooled, water-moderated power reactors. Four more reactors are planned to be added to this site. Under an inter-government agreement signed in December 2008 Russia is to supply four third generation VVER-1200 reactors of 1170 MW.

At the time of proposal of the project itself in 1987, the local people started protesting against it. The protests continued in different forms till 1989. After the breakup of USSR in 1989, when the project remained uncertain, the people's protest also slowed down. The opposition resurfaced soon after the project was revived in 1998. In November 2001, Dr. S. P. Udayakumar from Nagercoil and a few activists founded a broad umbrella organization called People's Movement Against Nuclear Energy (PMANE). Their main focus was public education. PMANE organizers visited numerous villages and towns in Kanyakumari, Tirunelveli and Thoothukudi districts

and talked to thousands of concerned citizens, women's associations, fishermen's associations, farmers' associations, student groups, teachers and religious leaders. Numerous public meetings, hall meetings, college seminars, group meetings and street side gatherings were also conducted and the protest movement started gaining strength.

After the Fukushima nuclear accident in March 2011, larger sections of the people felt that the danger was real and the protest movement was justified. From then on the people's protest became massive. Tens of thousands of men, women and children were engaged in different forms of protest including continuous relay fast in Idinthakarai, the ground zero. Fighting all odds, braving starvation, loss of livelihood, police action, the people are continuing their struggle with great determination and vigour. PMANE and other supporting organizations conducted conventions



The Koodankulam nuclear power plant.

Commentary

and public meetings at Madurai, Chennai, Nagercoil in which a number of scientists and scholars participated, and the movement has taken a broader shape.

PMANE also formed an expert committee consisting of geologists, scientists, doctors, environmentalists and people from other walks of life. This committee has raised several serious questions pertaining to the safety, natural hazards, economic viability, environmental aspects, liability issue etc.

Some of the important reasons cited by the people's struggle committee (PMANE) for opposing the project are :

The project is imposed on the people without following due democratic process of obtaining public approval through extensive public hearing and by allaying the fear of the local people about the possible hazards.

More than 1 million people live within the 30 km radius of the plant which far exceeds the AERB (Atomic Energy Regulatory Board) stipulations. It is quite impossible to evacuate this many people quickly and efficiently in case of a nuclear disaster at Koodankulam.

Nobody can rule out accidents in nuclear plants. It could be caused by various reasons such as operational errors as it happened in the case of Chernobyl, design faults (mechanical failure in the case of Three Mile Island), natural disasters etc. The March 11, 2011 disaster in Fukushima has shown that nuclear power plants are prone to natural disasters and no one can really predict their occurrence. When we cannot effectively deal with a nuclear disaster, it is only prudent to avoid it. For reasons of safety several industrially advanced countries have decided to either halt or phase out their nuclear power plants.

There is fear that fishing will be affected since fishing will not be permitted in the vicinity of the plant. The local people

also fear displacement as the project expands. The Tamil Nadu Government G.O. 828 (29.4.1991 – Public Works Department) establishes clearly that “area between 2 to 5 km radius around the plant site, [would be] called the sterilization zone.” People, living in this area, fear that they could be displaced.

The spent fuel will accumulate over the years and the hazard posed by it for hundreds of years is not addressed by the government. The safe disposal of nuclear waste is an unresolved problem in the world.

The coolant water and low-grade waste from the plant are going to be dumped in to the sea which will have severe impact on fish production and catch. This will undermine the fishing industry, push the fisher-folks into deeper poverty and misery and affect the food security of the entire southern Tamil Nadu and southern Kerala.

Even when the plant is functioning normally without any incidents and accidents, it would be releasing small amounts of radioactive isotopes of Iodine, Cesium, Strontium and Tritium into the atmosphere. People have apprehensions that this may adversely affect their health, and that of the flora and fauna of the surrounding area.

The important issue of liability on the part of the Russian supplier of the plants is not addressed by the government.

In October 2011, the Central Government set up a 15-member experts group for interaction with the people as part of an exercise to allay their apprehensions about the project. The experts group conducted discussions with a state level committee in which PMANE committee members were also present. Several questions related to the safety of the project, nuclear waste management, liability agreements etc. remained unresolved. Some questions were brushed aside by the expert committee say-

Commentary

ing that they were related to the country's security issues.

The government, after failing to give satisfactory answers to the people, resorted to suppressive measures such as filing false cases against the organisers of the movement (PMANE members) and also the general public. Cases like 'waging war against the country' are filed on the organisers and the public so as to intimidate the movement. The organizers are charged with receiving funds from abroad. Some of the Newspapers have also taken up the job of conducting false propaganda against the movement.

The movement has received wide support from the people of Tamilnadu and Kerala. But it is also true that a section of people under the influence of propaganda are in confusion whether to support the movement or not. Also the constant power cut in Tamilnadu for upto 6 Hours a day and hence the demand for more power production is being used as a tool by the governments to garner support in its favour.

Wildlife in danger

In the past one year there have been a number of cases of wild animals straying into areas of human habitation in search of food. There have been a number of instances of elephant herds over-running cultivated fields in West Bengal. The number of tigers straying into villages in the Sunderbans has also increased alarmingly over the past year. There has been cases of bisons straying into the villages adjoining the Jaldapara sanctuary in North Bengal. Leopards have strayed into highly populated suburbs of Guwahati.

All these are essentially signatures of loss of habitat for these wild animals. Rampant deforestation and human encroachment into forest land are mainly responsible for the situation. The elephants are



A leopard attacking a forest department employee in a Guwahai suburb.

not finding enough food because of the deforestation, and because of the wrong government policy of planting eucalyptus in place of the indigenous species of trees. The dwindling food supply in the Sunderbans is forcing the Royal Bengal tiger to look for food in the villages. Similar is the plight of the leopard in the Assam forests.

In case of tigers and leopards, the approach of the Forest Department has been to tranquilize the animal, and to release it back into a forest area. But this approach is not likely to work, because such predators are fiercely territorial animals. When a tiger is released into the forest, it would typically find itself in another tiger's territory. It would be forced to leave that area, and after a few days of going without food would, in all probability, come back to areas of human habitation.

The solution of this problem is to check deforestation and human activity in the core areas of the forests. In this, the local villagers are not to blame—because it is mostly the unscrupulous traders in the forest produce who lure the poor villagers into this trade. Also the rich-man's entertainment going in the name of eco-tourism are to blame for the loss of secure habitat. □

E-Waste and Its Management: an Emerging Problem

Abhijit Mitra *

IN THIS ARTICLE, we deal with an emerging environmental issue: electronic waste or e-waste. Starting from the common notions about e-waste, we discuss about various environmental and health hazardous aspects caused by e-waste elements. E-waste management techniques in India and the upcoming 'e-waste management and handling rules, 2011' are taken up next. The article is concluded by pointing certain open problems, still not addressed in this upcoming e-waste management rule.

What is "E-waste"?

Electronic waste (in short, 'e-waste'; sometimes also referred to as 'e-scrap') or Waste Electrical and Electronic Equipment (WEEE) means discarded or obsolete electrical and electronic devices [1]. The common examples of electrical and electronic equipments (EEEs) include personal computers, laptops, printers, xerox machines, facsimile machines, telephones, mobile phones, television sets, radio sets, refrigerators, washing machines, air conditioners, microwave ovens, electronic watches, batteries etc. In short, we are surrounded by EEEs in modern lifestyle almost everywhere. When any of these EEEs become obsolete or are dis-

carded for their defects, they turn out as 'e-waste'. According to composition, e-waste is broadly classified into four categories: e-waste of large household appliances (TV, refrigerator etc), e-waste of information and communication technology (ICT) equipments (computer, mobile phone etc), e-waste of small consumer electronic devices (calculator, camera, audio device etc) and e-waste of other materials (batteries, wires etc). Some of the e-waste devices are shown in Figs. 1-3 along with their composition chart in Fig. 4.

Along with the rapid changes in technology, many of the electronic equipments become obsolete frequently. In particular, the electronic devices used for information and communication purposes are most likely to become e-waste in a short time. According to internet sources, an estimated 50 million tons of e-waste are produced every year. This volume is alarmingly increasing day by day. However, the main problem with e-waste is that it is not like any other household garbage material and contains carcinogenic materials like arsenic, lead, cadmium, phosphor, beryllium, brominated flame retardants, polyvinyl chloride, chromium etc, thereby making it a serious cause for health problems and pollution. Another concern with e-waste is that only 15-20% of e-waste is recycled, the rest is simply dumped for landfill purposes. In fact, during recycling of e-waste, the unaware and informal

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Figure 1: E-waste of computers (ICT) equipments.

processing of such materials involves significant risk to its workers and communities. E-waste management, therefore, is of utmost importance in today's complex life style so as to keep the human race as free as possible from this new source of hazards.

Health Hazard/Pollution Aspects of E-waste

Before we proceed to the management of e-waste, let us have a quick look at different elements in e-waste that are termed as most dangerous for health related problems as well as environmental pollution. The following alphabetical list is partly taken from [1] and partly from [2].

(a) Arsenic: this is a poisonous element (also present in dust and soluble substances) that is cited as a cause of many ailments ranging from liver cancer to lung cancer; mainly found in printed circuit

boards, and light emitting diodes.

(b) Beryllium: can cause lung cancer and skin disease; mainly found in thermal interface materials on heat sinks for computer motherboards and transistors.

(c) Brominated flame retardant (BFR): causes impaired development of nervous systems, thyroid problems, liver problems; mainly used as flame retardants in plastics in most EEEs.

(d) Cadmium: causes trouble to kidneys; mainly found in semiconductor chips.

(e) Hexavalent Chromium: can cause damage to DNA and is extremely toxic for the environment; found in galvanized steel plates.

(f) Lead: causes trouble to central and peripheral nervous system; mainly found in glass panels in cathode-ray tubes (CRTs), solders, and lead-acid batteries.

(g) Mercury: can cause damage to brain,

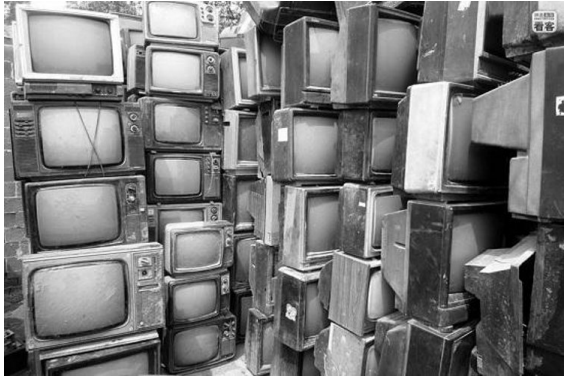


Figure 2: E-waste of large household appliances.

kidney as well as fetus; found in fluorescent tubes, thermostats, sensors, relays, switches.

(h) Phosphor and additives: extremely toxic for environment; found mainly in CRTs.

(i) Polyvinyl chloride: can lead to severe respiratory diseases; frequently used in plastic wires in everyday EEEs.

(j) Sulphur: responsible for liver, kidney and heart damage, eye and throat irritation; mainly found in lead-acid batteries.

E-waste Management

As the population of the world increases, so does the amount of e-waste and it all has a drastic effect on the planet. The e-waste is usually thrown into a landfill, recycled, reused or melted down and made into new objects, and there exists considerable health and environmental risks in all such cases, as said earlier. The developed countries (such as the USA) therefore usually do not take the risk of recycling or melting down the e-waste and simply export it to countries like China, India, Pakistan, Kenya or Ghana. The question is, why? The answer is, by doing so, they avoid the expense of properly processing items like old Cathode Ray Tubes (CRT). Such pro-

cedures are quite expensive, difficult and hazardous. CRTs are actually considered to be the hardest type of e-waste to recycle. As shown in Section 2, CRTs actually have quite high concentration of lead and phosphors, both of which are necessary for display. While removing a CRT by hand as an e-waste, these two materials cause tremendous pollution. In the USA, the Environmental Protection Agency (EPA) has already declared caution against CRT production.

However, lured by the possibility of a profitable business, the countries like India are taking the burden of most of e-waste processing. Presently, there are some e-waste management centres in places like New Delhi, Kolkata, Chennai, Bangalore, Mumbai and Pune. It is expected that the companies that operate in these cities would comply with the policies of Central Pollution Control Board (CPCB) so that the e-waste devices spread minimum amount of hazard while dismantling or recycling. The CPCB policies elaborately demonstrate the approach with public safety while recycling the e-waste. These guidelines describe that one should first identify the category of the e-waste and the composition of the same in the sequel. Then only the centre has to plan proper recycling/disposal of the e-waste. The flow-chart of the policy followed in New Delhi is given in Fig. 5. Nevertheless, e-waste management is such a burning topic in a hugely populated country like India that people should be aware of it. In [2], along with the list of the hazardous e-waste materials, certain chemical processing remedies from these materials are also presented. For the benefit of our readers, some of the presented techniques in [2] are repeated in the following.

(a) Cadmium: Since Cadmium oxides and carbonates are non toxic, the pollution due to Cadmium can be prevented by aerial oxidation using Manganese oxide (MnO) as



Figure 3: E-waste of mobile phones (ICT equipments).

catalyst.

(b) Hexavalent Chromium: Chromium can be eliminated from water (or even soil) by treating the material with Carbon dioxide (CO₂) under pressure in moist condition. This reaction forms Chromium oxide.

(c) Lead: This dangerous element should be disposed along with Sodium carbonate so as to form Lead carbonate and Sodium metal, which is non toxic.

(d) Mercury: Human body has a tendency to accumulate Mercury in the body organs in any form. Mercury easily forms nitrates and chlorides, which are ionic in nature and those can be excreted by kidneys with a lower toxicity level. Thus, Mercury rich materials should be burnt in presence of oxidizing agents such as nitric acid or Potassium iodide which easily converts Mercury to nitrates or iodides.

The Environmental Issues

It is already discussed that various carcinogens in e-waste like lead and arsenic are critical and pose serious health risks and environmental dangers. To get a feel for the level of danger they pose, let us consider one example. The toxins contained in only one CRT type monitor can pollute 87 tons of water, which is the amount of drinking water consumed by a human being over the entire lifetime! (Considering 3 litres of water consumption per day and average life expectancy of 80 years.)

However, one Chinese town has shown a critical example of how dangerous the e-waste can be, if not handled properly. Guiyu is a small town on the South China Sea coast, which is infamous for its huge reception of e-waste and also for being the largest e-waste site on earth [3]. The work-

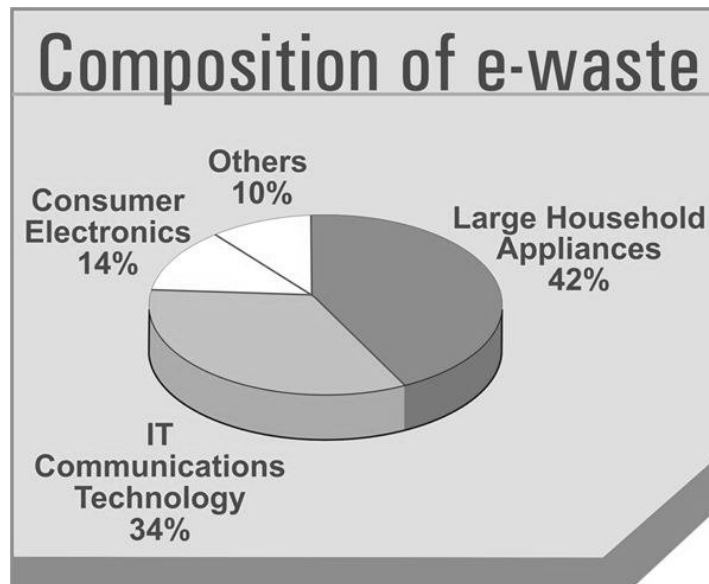


Figure 4: Classification of e-waste along with their composition chart.

ers in this small Chinese town strip off the metal and plastic by their own hands and sometimes burn the plastics in the town itself. As a result, presently nearly 80% of its children have dangerous levels of lead in their blood. Additionally, the main irrigation canal of this town has almost been choked with imported e-waste, resulting in serious problems of the agriculture of that land. A part of this serious problem is shown in Fig. 6.

This shows that the same might happen in India too, if proper precaution is not taken while importing and processing the e-waste. Fortunately, the Government of India have lately realized its hazardous effects and therefore have prepared a new set of rules in this aspect. The good part of this law is that it has given emphasis on 'environmentally sound management of e-waste' to ensure that e-waste is managed in a manner which will protect health and environment against any adverse effects, and this rule has also specified the responsibil-

ities at various levels. This new set of rules is briefly given below.

E-Waste Management and Handling Rules, 2011

The Ministry of Environment and Forests, Government of India, have circulated a new set of rules called 'E-Waste Management and Handling Rules, 2011' which would be effective from May 01, 2012 across the entire country [4]. This rule defines the terms such as 'electrical and electronic equipments', 'e-waste', 'environmentally sound management of e-waste' etc. and separately points out the responsibilities of the producers, collection centers, consumers, dismantlers and recyclers. Further, it introduces the legitimate procedure for seeking authorization and registration of handling e-wastes, and seeks to reduce the use of hazardous substances in the above defined EEEs. As per this rule, the producers of EEEs would be mainly responsible for col-

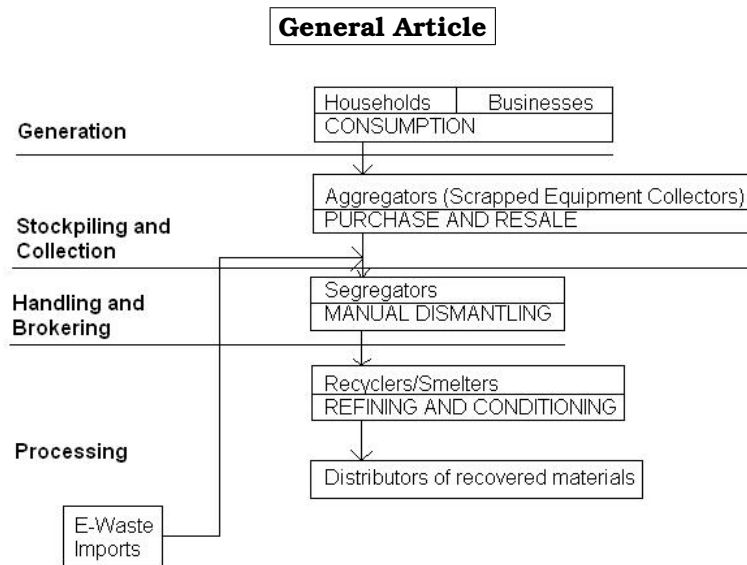


Figure 5: A sample CPCB policy for e-waste processing. It clearly shows that e-waste is imported to India.

lection of e-waste, while the responsibilities of the dismantler and the recycler would be to comply with the rules of CPCB/SPCB to ensure proper management. The responsibility of the user is mainly to ensure that no e-waste is dropped in the common garbage bins containing waste destined for disposal (please remember that even tiny batteries also contain carcinogenic materials and thus should NOT be dropped in common disposal bins). It should be noted that as per this new rule, the producers of all types of EEEs have to open collection centers at certain places. The users have to ensure that e-waste is dropped only in those specified e-waste collection centers. With the introduction of this rule, it is expected that e-waste management in future will be streamlined in India from different corners and the current scenario would change effectively.

There are, however, certain open issues in this regard which are not yet treated in the said rule. Firstly, the Government should try to improve the e-waste management system utilizing the techno-

logical developments and through further R&D, possibly involving the Indian institutes/organizations (such as some of the alternative remedies as given in [2]). Secondly, protective protocols for employees working in such e-waste management centers are urgently needed. Thirdly, a continuous surveillance by the Government is required; else the e-waste management centers may try to make extra profits by bypassing the rules and regulations. And finally, it should be a part of the Government's policy to take active steps to spread awareness about this problem among the common people so that they fully understand the health and environmental threats of e-waste.

Conclusion

Proper recycling of the end-of-life EEEs is the most effective solution to the growing e-waste problem. However, we should also note that any slip from 'proper recycling' might lead to another Guiyu in our country

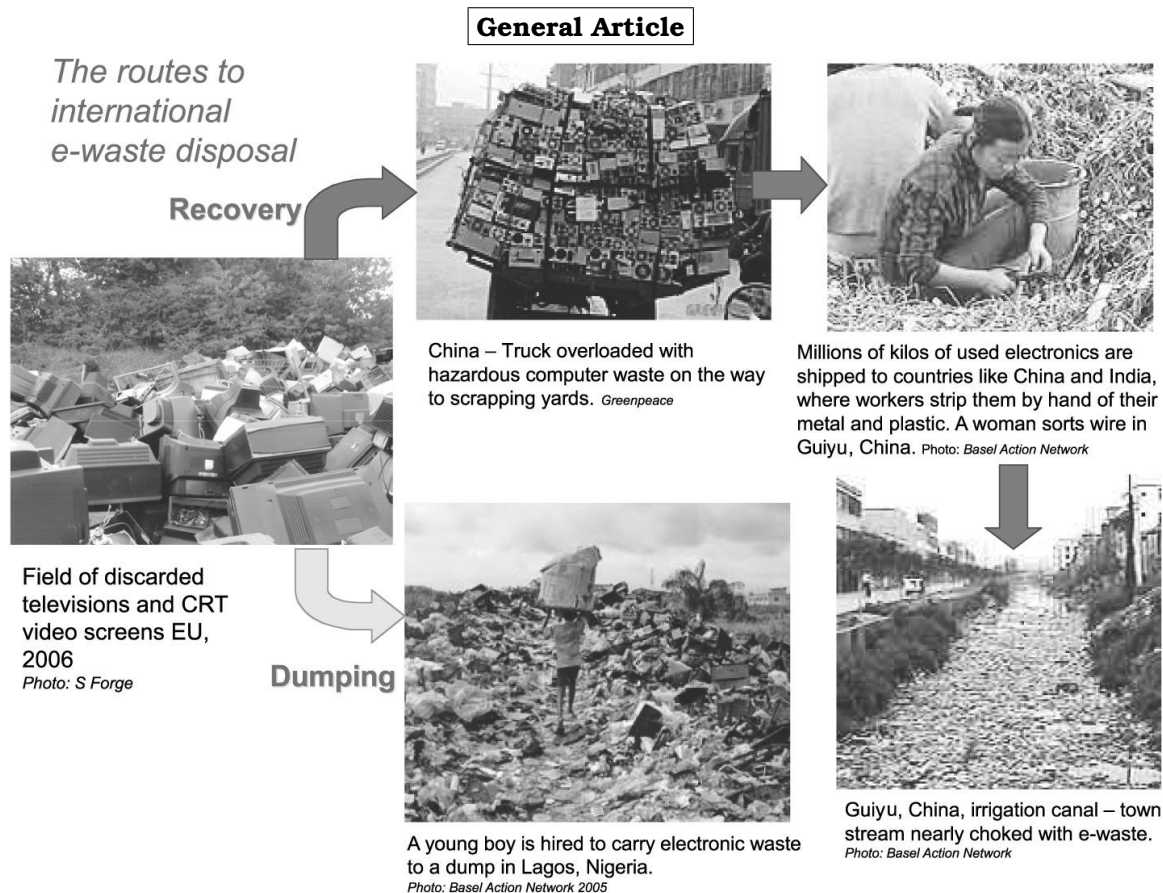


Figure 6: Unaware handling of e-waste that causes serious risk: with the example of Chinese town Guiyu.

too. The Government of India's measure to introduce 'E-Waste Management and Handling Rules, 2011' to be enforced across the country from 2012 is surely welcome. But simply creating a set of rules will not solve the problem.

One has to remember that the motive to earn maximum profit will drive the companies to subvert the rules. Therefore effective mechanisms for enforcing the rules, and creation of mass awareness are necessary. After all, a mass awareness is the key toward a green planet in future, which can-

not be achieved merely by making laws. □

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2. M. Mathankar et. al., "Some Remedies to Minimize the Pollution due to E-waste," *Everyman's Science*, vol. XLV, no. 6, pp. 351-355, Feb.-Mar. 2011.
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Galileo's experiment on falling objects

George Joseph

ONE OF THE MOST celebrated experiments in science is the Leaning Tower of Pisa experiment conducted by the legendary scientist Galileo in the 1590s. Till then people believed what Aristotle had said more than a thousand and five hundred years before, that heavier objects fall faster than lighter ones; a 10kg iron ball would fall 10 times faster than a 1kg one. Blind beliefs of the dark ages had imprisoned the minds of men so much so that nobody ever bothered to test it even



The Leaning Tower of Pisa, where Galileo conducted his famous experiment.



Astronauts conducting the "Galileo experiment" on the moon.

though a school boy could have done it. It needed a man of Galileo's brilliance to conduct the simple experiment he did at the leaning tower of Pisa. He dropped balls of different masses from the Leaning tower of Pisa in Italy and found that all of them struck the ground at the same time. From this experiment he concluded that all objects irrespective of their masses are accelerated by the same rate towards the earth. Even a feather would fall at the same time as an iron ball when dropped from the same height in the absence of air resistance.

This was demonstrated later by scientists using a vacuum tube. Astronauts David Scott and Jim Irwin during the Apollo 15 mission reconstructed Galileo's famous experiment on the Moon by dropping a hammer and a feather. A video of this demonstration is available on the Youtube.

Galileo was a master experimenter. He had devised several simple but ingenious experiments, such as the simple pendulum, the inclined plane, etc., to study the motion of bodies. His studies led to the formulation of the basic laws of motion that was perfected by another giant thinker Isaac Newton born in the year Galileo died. □

Organizational News

TAMIL NADU

Celebrating Madam Curie

The Literary Association, Dept. of English, Presidency College, Chennai and Breakthrough Science Society, Tamilnadu Chapter jointly organized a program commemorating Madame Curie on Dec 23, 2011. The program included an exhibition of charts prepared by the students containing selected quotations from Madam Curie, the screening of a documentary on Madam Curie, an interactive session with students and talks by Shri. George Joseph and Dr.S.H. Thilgar on the life and works of Madame Curie. Prof. Ramachandran, Principal, Presidency College was the special guest. Dr. Vedavalli, HOD, Dept. of English presided.

Discussion on Darwin

A documentary 'Darwin and the Tree of life' in Tamil was screened at Vyasarpadi, Chennai on Dec 31, 2011, followed by a discussion with students and children on the theory of evolution. The discussion was conducted by by Shri. Balaji Babu and Shri. Venkatesan.

KERALA

ERNAKULAM DISTRICT

Nov.12, 2011: Talk on 'Koodamkulam and the Implications of Nuclear Energy' by Prof. Gopalakrishna Panickar, Head of the Dept. of Physics, NSS college, Changanassery.

Dec. 10, 2011: Talk on the 'History and Science of Eclipses' by Shri. C. Ramachandran (Retd. Scientist, ISRO) at P.W.D. rest

house, Thrippunithura.

Jan. 8, 2012: Breakthrough Science Society district chapter organized one day science workshop on Astronomy at F.A.C.T Ambalamed club auditorium. Shri. K.V. Sukumaran, General Manager, FACT inaugurated the function. Shri. Francis Kalathunkal, P.P. Sajivkumar, K.S. Harikumar, P.P. Abraham, K. Thankappan and Prof. P.N. Thankachan took classes.

Jan.1, 2012: As part of the 'Learning Science Through Experiments' programme, the Breakthrough district chapter organized a series of experiments in chemistry at PWD rest house, Thrippunithura. Shri. Joseph Dennis, Binu C, K. Lasitha and P.P. Sajivkumar displayed the experiments.

Feb.11, 2012: Talk and power point presentation on the 'History and Facts regarding Mullapperiyar' by shri. P. Rajendrakumar, Executive Enginner, Kerala Irrigation Department. The programme was organised in the backdrop of a serious tug of war between Kerala and Tamilnadu on the issue. Dr. K. Sathynathan, Aliyamma Thomas, Nirmal V.G, B. Sandya, P.P. Abraham and Smt. Ajitha B.V spoke. Shri. Francis kalathunkal presided the function.

TRISSUR DISTRICT

Jan. 18, 1012: Talk on 'Science and Ethics' by G.S.Padmakumar at Little Flower College, Guruvayur as part of the Chemistry Year Celebration. Also exhibition on Madam Curie prepared by BSS was shown.

Feb. 11, 2012: Madam Curie memorial lecture by Joshua. P.A., district co-ordinator, BSS at Sree Kerala Varma college, Thrissur. Presided by Principal Dr. Sudha. Also ex-

Organizational News



Collective viewing of the Lunar Eclipse on 10th December at the Thevara SH College, Kerala.

hibition on Madam Curie prepared by BSS was shown.

Feb 13, 2012: Exhibition on Madam Curie prepared by B.S.S. at St. Mary's College, Thrissur.

KOTTAYAM DISTRICT

Nov.12, 2011: Learning Science through Experiments in Chemistry at Vadakara, Thalayolapparambu in association with 'Prachodana', Vadakara. Prof. P.N. Thankachan and Sumesh A G led the workshop.

Dec.10, 2011: Lunar Eclipse Observation at Kottayam Town. Amateur astronomer K.Thankappan led the programme.

Jan.30, 2012: Sky Watch at St. Gits College of Engg. Pathamuttom, Kottayam using 5-inch Telescope. Prof. P.N. Thankachan took the classes. Lekha Susan, faculty member and Prof. P.C.Kurian, HoD, Dept. of Mathematics also spoke on the occasion.

Jan 28-31, 2012: Star World Exhibition stall by Amateur astronomer K. Thankappan at Science Expo at Mamman Mappila Hall Kottayam. BSS Volunteers played key role in running the stall.

Madam Curie Exhibitions:

Dec.3, 2011: Kendriya Vidyalaya, Kottayam

Dec.8, 9, 2011: CMS College Kottayam. Dept. of Chemistry organized the programme.

Jan.12, 2012: Navodaya Vidyalaya Kottayam

Jan.24, 2012: Govt. College Nattakom, Kottayam Dept. of Chemistry organized the programme.

Astronomy Club, Kottayam (Organized with the cooperation of Jawahar Balbhavan Kottayam):

Nov.12, 2011: Workshop on Learning Science Through Experiments in Chemistry by Dr.Jacob George (Retd. Prof., Dept. of Chemistry, CMS College, Kottayam)

Dec. 12, 2011: Talk on Earth Quakes by Dr. Beno Joseph (HoD, Dept. of Geology, Govt. College Nattakom)

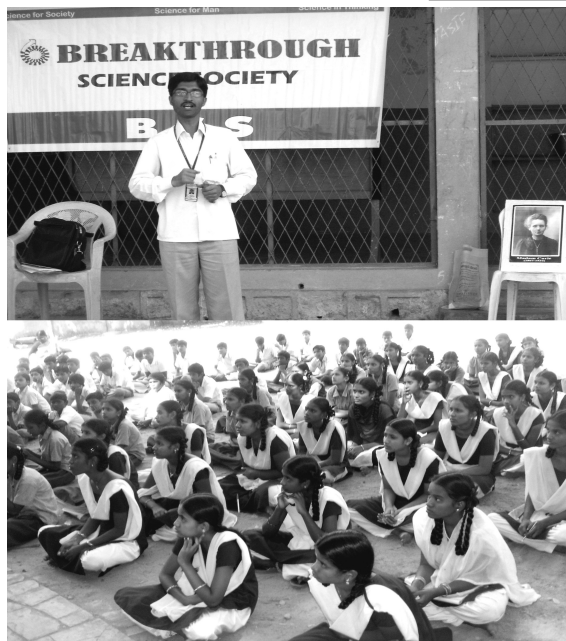
Jan.14, 2012: Workshop on 'Origami' by Sreenivasan of the BSS

Feb.11, 2012: Class on HAM RADIO by Kottayam Amateur Radio Club

Andhra Pradesh

December 12, 2011: International Year of Chemistry observed in Government High School, Erramanzil, Hyderabad.

Organizational News



Mr. Gangadhar speaking at the programme at Erramanzil, Hyderabad.

Mr. R. Gangadhar was the main speaker, and Mr. Gangaji, Incharge Hyderabad chapter, presided over the meeting.

December 21, 2011: A discussion on science and development of society organised by Hindupur BSS Chapter at M.R. Pally Govt High School. Mr. Mallikdutt was the main organiser.

December 5, 2011: A meeting in memory of Madam Marie Curie organised by Mrs. Tejovathi at Govt. Women's Degree College, Visakhapatnam. On this occasion a new science organization named "Madam Marie Curie Memorial Science Forum" was formed.

January 6, 2012: A meeting on Madam Marie Curie and her scientific inventions was conducted by Hindupur BSS Chapter at Kodigenahalli Jr. College. Mr. Mallikdutt and Mr. Ramesh were the main organizers.

WEST BENGAL

All Bengal Science Camp

On the occasion of the International Year of Chemistry, especially in memory of Madame Curie's contribution to science, an All Bengal Science Camp was organized at Dattapukur, North 24 Parganas, on 17-18 December 2011. The theme of the camp was "The Ethics and Method of Science."

On 17th morning, the camp was inaugurated by Prof. Amitabha Ghosh, former Director of IIT Kharagpur and former Professor, IIT Kanpur. The inaugural session was presided by Prof. Dhruba Mukhopadhyay, President of *Breakthrough Science Society*. In the afternoon session, the speakers were Prof. Ashoke Prasun Chatterjee (Kalyani University), Prof. Gourishankar Ghatak (Retired Professor of Presidency College), and Prof. Ajay Ray (Vice-Chancellor, Bengal Engineering & Science University, Shibpur). The session was presided by Prof. Ashoke Kumar Mallik (Jadavpur University).

After this session the participants were divided into five parts to conduct group discussions. Then there were two parallel sessions: an anti-superstition show and sky-watching through telescope.

On 12th morning the first session was on the method of science. Prof. Soumitro Banerjee, General Secretary of *Breakthrough Science Society* dealt with the subject. After that Sri Debasis Ray, one of the Vice Presidents of BSS, gave the concluding address touching upon the questions that remained unanswered in the group discussions.

Other programmes

23 Nov: Discussion on the Life and Work of Acharya P. C. Ray at the Ballygunge Science College, Kolkata. Speaker: Dr. Soumitro Banerjee

Organizational News



The speakers at the dias of the All Bengal Science Camp on 17th December 2011. From right: Prof. Ajay Ray (speaking), Prof. Ashoke Kumar Mallik (President), Prof. Ashoke Prasun Chatterjee, Prof. Gourishankar Ghatak, and Prof. Soumitro Banerjee.

24 Nov: Discussion on Doomsday 2012, at Baichi, Hooghly district.

5 Dec: Discussion on Doomsday 2012, at Nistarini College, Purulia district.

1 Jan: Anti-superstition show at Birati, organized by the Galileo Science Forum, Nimta, Kolkata.

2 Jan: Discussion on “Science & Scientific Outlook” at the Galileo Science Society, Baranagar, Kolkata

5 Jan: Sky-watching at Balurghat, North Dinajpur district.

7 Jan: Discussion on the Life and Work of Acharya P.C. Ray, at Bagnan, Howrah district.

13 Jan: sky watching camp at Panskura Banamali College; speaker: Radhakanta Konar

15 Jan: Sky-watching at Nimta, organized by the Galileo Science Forum, led by Chandan Santra

16 Jan: Discussion at Guru Nanak Polytechnic on the Life and Work of Acharya P. C. Ray; speaker: Chanchal Ghosh

18 Jan: Discussion at the Konnagar Book Fair – Life and Works of P. C. Ray; speaker: Chanchal Ghosh

25 Jan: Anti-superstition show at Dakshin Barasat, by the Galileo Science Forum volunteers, led by Nirmal Duari

5-9 Feb: Science model exhibition by Pan-

skura Science Centre at the Panskura Town Utsav and Science Fair. On 7 February there was a Slide show on Doomsday 2012; speaker: Chanchal Ghosh. On 8 Feb there was an 'anti-superstition programe' by BSS volunteers as a part of the Science Fair.

11 Feb: Anti-superstition show at Joynagar Loksanskriti Mela by Meghnad Saha Bigyan Sanstha. Chanchal Ghosh

JHARKHAND

2 October 2011: The Discovery of Science Society of Chandrapura, Bokaro, organized a Seminar on “Remembering Madam Curie—the shining star of Humanity in the history of science.” Mr. Chanchal Ghosh was the main speaker on behalf of *Breakthrough Science Society*. Mr. Kanay Barik, the Jharkhand state in-charge of BSS, and Mr. Patit Pawan Koyla from the Einstein Club of Ghatsila also spoke. After the seminar there was a session on ‘Learning Science Through Experiments’. About 170 students and 15 teachers of different Schools and Colleges participated in the programme.

3rd Dec. 2011: On the occasion of International Year of Chemistry, the Jharkhand Chapter of BSS Organized a discussion on the life-struggle of Madame Curie at the Mahila College Chaibasa. Dr. Soumitro Be-

Organizational News

narjee (G.S. of BSS) was the main speaker. Dr. Solil Kr. Roy (V.C. of KU) was the Chief guest. Around 200 students Participated.

21st Dec 2011: A programme of "learning science through experiment" was organized by the Einstein Club, Ghatsila. Around 100 students of different Schools and Institutes participated.

Apart from these, the Einstein Club, Ghatsila, organized a number of discussions on the life straggle of Madame Curie at different schools and colleges near Ghatsila.

BIHAR

On the occasion of the Cancer Day (4 February), a discussion on the life and work of Madame Curie was organized at the MLSM College, Darbhanga. The speakers were Dr. Gopikanth Jha, Dr. Braj Mohan Mishra, and Mr. Prashant Kumar. Dr. Santosh Kumar Singh presided over the programme.

UTTAR PRADESH

21 Jan: Science exhibition and discussion on "Doomsday 2012" at Rabatpur Coaching Centre, Kanpur, UP.

22 Jan: Science exhibition and discussion at Derapur, Ramabainagar, UP.

24 Jan: Science exhibition and discussion on "Doomsday 2012" at a coaching centre near Maharana Pratap Education Centre, Kanpur, UP.

BSS organizer Dinesh Mohanta spoke at these programmes.

KARNATAKA

The Karnataka Unit of Breakthrough Science Society has actively organised lectures on 'The life and works of Madame Curie' in the background of the International Year of Chemistry, across various districts of the state. Lectures have covered a wide group of audience including school students,

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Mr. G.Satish Kumar, the state convenor of the Karnataka unit has addressed hundreds of students and teachers on 'The life and scientific works of Madame Curie' at various educational institutions. The list is as follows: Around 50 high school teachers at Government School at Magadi, Bangalore Rural District in the month of October 2011; around 200 high school students at St.John's High School, Bangalore on 22-10-2011; around 200 school students at Sri Vinayaka Sunrise High School, Bangalore on 29-10-2011; around 100 post-graduate students of the Physics Department, Bangalore University on 12 Nov, 2012; around 300 graduate and post-graduate students at MES Degree College on 19 Jan, 2012.

Along with these programmes, a few more were organised on other topics, all of which were addressed by Mr.G.Satish Kumar. Around 200 Engineering students at BMS Engineering College, Bangalore on the topic 'How to think scientifically' in December 2011.

A short movie and talk was organised on lunar eclipse to the general public at MLA College Auditorium. In this programme around 100 citizens participated after which public viewing of eclipse was organised using binoculars.

A two-hour talk show on "Doomsday 2012" was organised by a Kannada TV Channel Kasturi News 24 × 7 for which Mr. Satish Kumar from Breakthrough Science Society was invited to uphold the scientific position against two leading astrologers. A similar talk on the same topic was organised by another Kannada TV Channel Suvarna, with Mr. Satish Kumar as the lead speaker. ☐