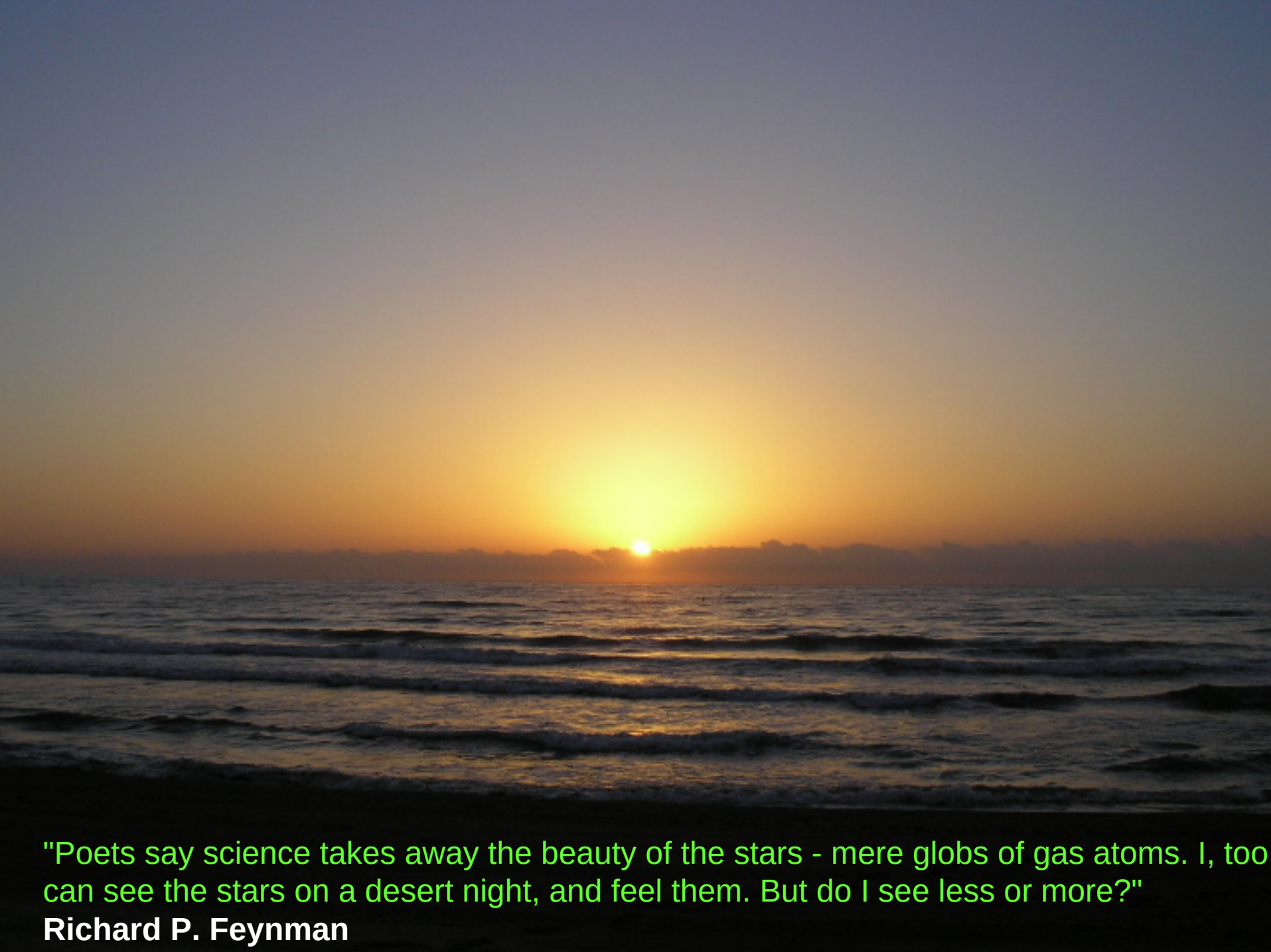
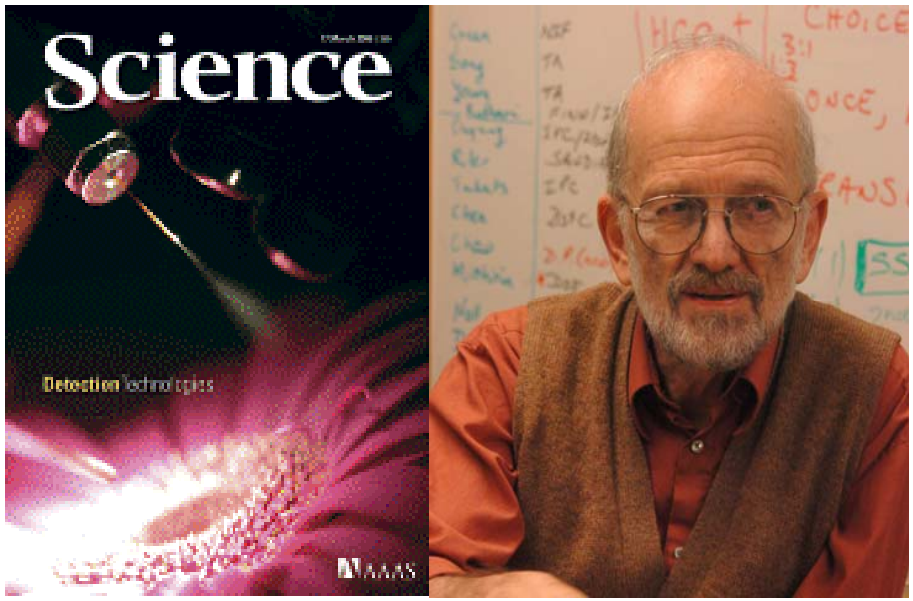


"Poets say science takes away the beauty of the stars - mere globs of gas atoms. I, too can see the stars on a desert night, and feel them. But do I see less or more?"
Richard P. Feynman


Vincent


Science
Detection Technologies
AAAS

http://www.culture.gouv.fr/culture/arcnat/lascaux/en/

Communicating research

Communicating art

Why do I communicate?
What do I communicate?
How do I communicate?

Why do I do science?
Why science? Why not other?
…….

W^2H problem

Science is what scientists do.
Michael Polanyi
Science is a *social construction* of scientists

Why and what are often mixed.

Why and the realities
Why and society
Why and science itself

Let us look at science from the top

Facts of 2000's

Average intelligence (IQ) increased by 30 points in the developing world after WWII.

Affluent middle-class is reaching the limits of intelligence (without genetic/pharmaceutical help).

Genetics decides intelligence for middle-class, environment decides it among the poor.

Brain prosthesis will become a reality for the public in 2030.

Individual neurons have been connected with carbon nanotubes.

Performance enhancing pharmaceuticals (modafinil) can make one alert up to 37 h without sleep.

Reasons for spiritual bliss and enjoyment are supposedly chemicals.

Cochlear implants can extend the limits of audibility and may eventually communicate with telecommunication devices.

Dobelle Vision System, linking video cameras to visual cortex has made it possible to see for the blind.

Creative state can be understood and mood can be controlled.

Brain to brain communication is expected to be possible, including text, audio and video.

J. J. Hughes, Futures 39 (2007) 942-954

Predictions

So, are we going to become super humans? And others become primates?

How do we exercise compassion, empathy? Oxytocin induces trust in humans.

All can be a Gandhis. Or total chaos.

Social systems can he highly cooperative or there can be terror!

We can also look at it from the bottom

Most challenging problems

Energy
Water
Population and associated issues
Land
Food and agriculture
Pollution
Biodiversity
Weapons
Diseases
Natural calamities

Statistics at a glance

World

Population: 6,602,224,175 (July 2007 est.)
GDP (official exchange rate): $46.76 trillion (2006 est.)
GDP - per capita (PPP): $10,200 (2006 est.)
GDP - composition by sector:
agriculture: 4%
industry: 32%
services: 64% (2004 est.)
Labor force:3.001 billion (2005 est.)
Labor force - by occupation: *agriculture:* 40.7%
industry: 20.5%
services: 38.8% (2002 est.)
Unemployment rate:30%

India

Population: 1,129,866,154 (July 2007 est.)
Age: 24.8
GDP (official exchange rate): $804 billion (2006 est.)
GDP - per capita (PPP): $3,800 (2006 est.)
GDP - composition by sector:
agriculture: 19.9%
industry: 19.3%
services: 60.7% (2005 est.)
Labor force:509.3 million (2006 est.)
Labor force - by occupation:
agriculture: 60%
industry: 12%
services: 28% (2003)
Unemployment rate:7.8% (2006 est.)
Population below poverty line:25% (2002 est.)

USA

301,139,947 (July 2007 est.)
36.6
$13.21 trillion (2006 est.)
GDP (PPP): $44,000
GDP composition by sector:
agriculture: 0.9%
industry: 20.4%
services: 78.6% (2006 est.)
Labor force: 151.4 million (includes unemployed) (2006 est.)
Labor force - by occupation:
farming, forestry, and fishing 0.7%, manufacturing, extraction, transporta
professional, and technical 34.9%, sales and office 25%, other services

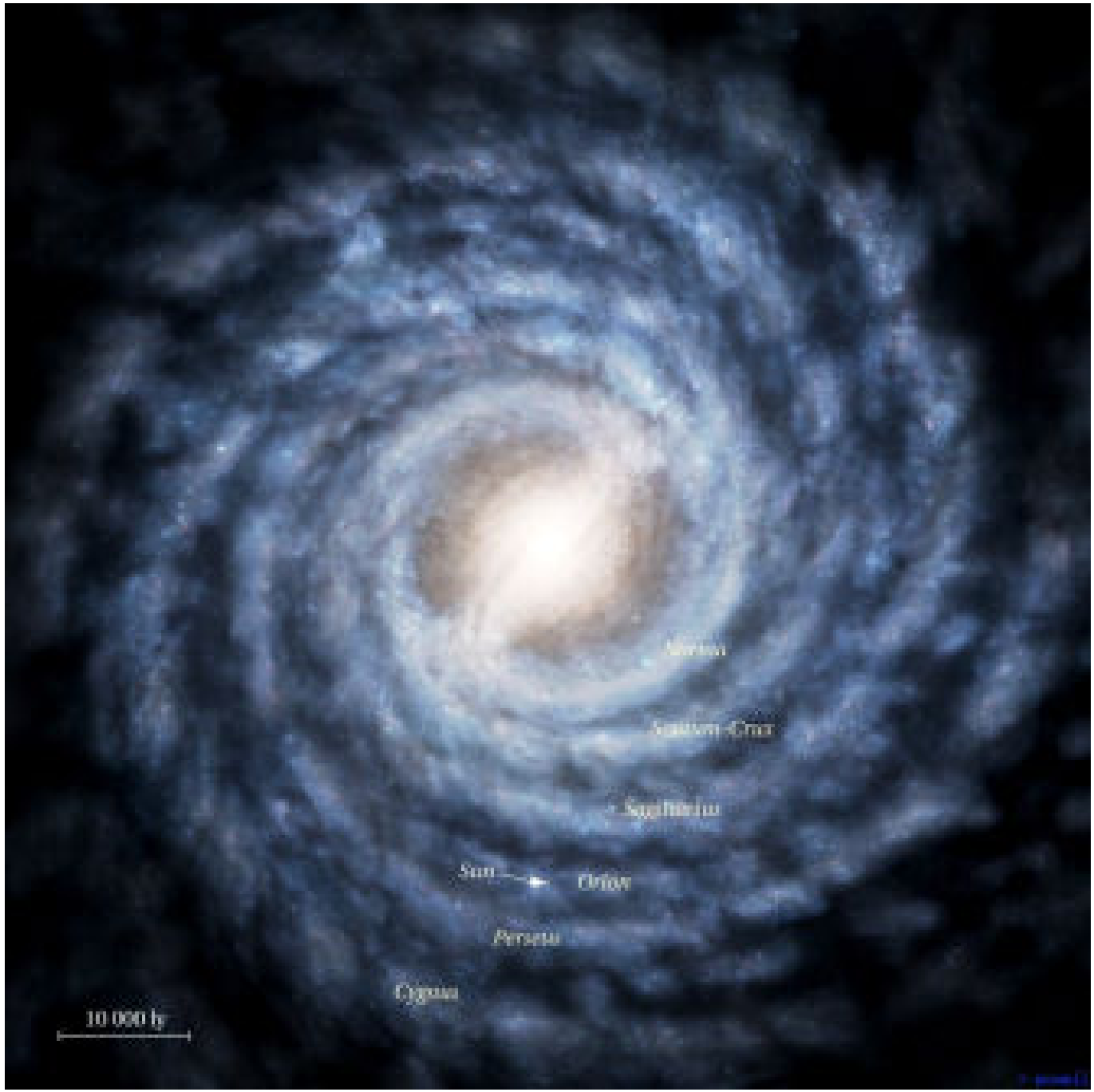
Unemployment rate:4.8% (2006 est.)
Population below poverty line:12% (2004 est.)

World Fact File, 2007

Food production and consumption in (Mtones)

2000	1,838	1,855	-16
2001	1,870	1,898	-27
2002	1,819	1,910	-91
2003	1,827	1,932	-105

Solutions?

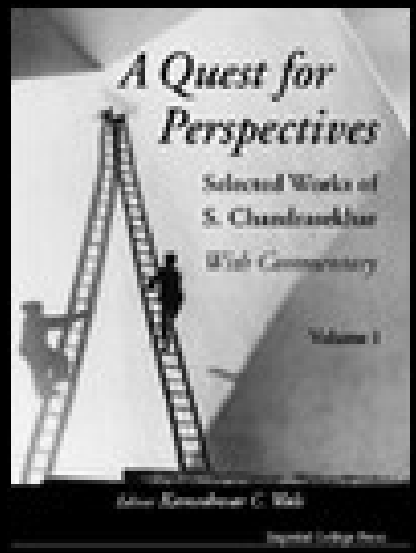

Norma
Sagittarius
Sun
Orion
Perseus
Cygnus
10 000 ly

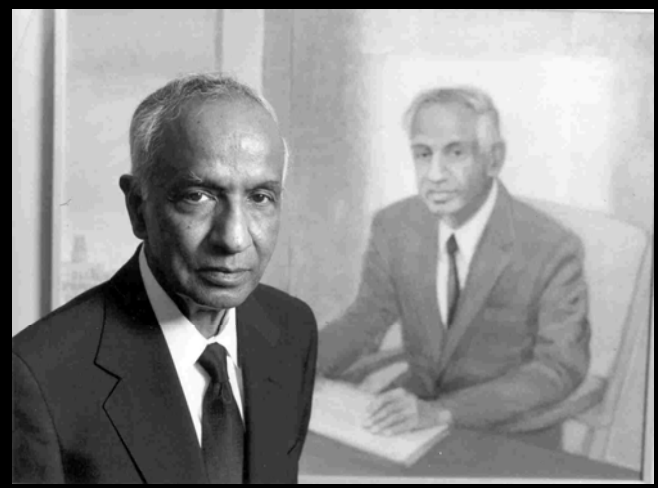
“Problems are on the street.. you need to walk to discover them”

C. V. Raman

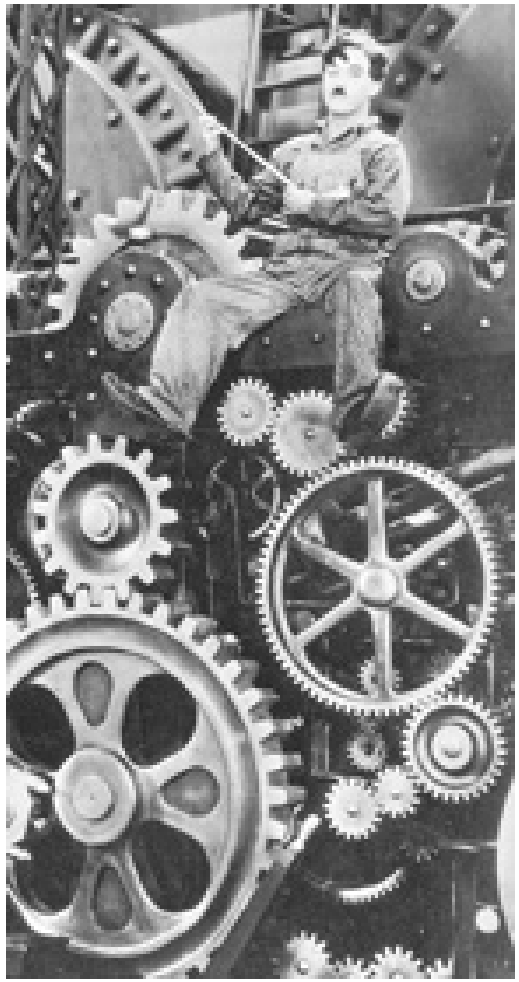
You have to walk

If I have seen further it is by standing on the shoulders of Giants.
Isaac Newton





Polanyi



Curriculum has forgotten instrumentation

Masters curriculum of chemistry in IIT

Experiments in physical chemistry

- Kinetics,thermodynamics (12)
- Electrochemistry (12)
- Analytical chemistry (12)

No instrumentation

No workshop

No glass blowing

No instrumentation PhD for the past 4 years

A multimeter is unknown

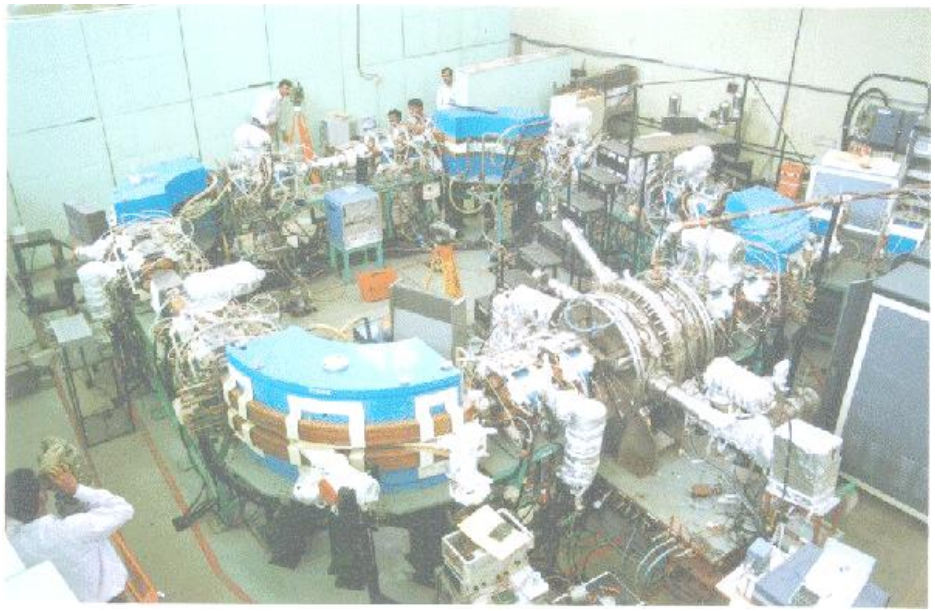
Mechanical workshops have been removed or severely down-sized.

Electronics laboratory is not part of instruction for several materials science programmes.

Decreasing instrumentation component in PhD

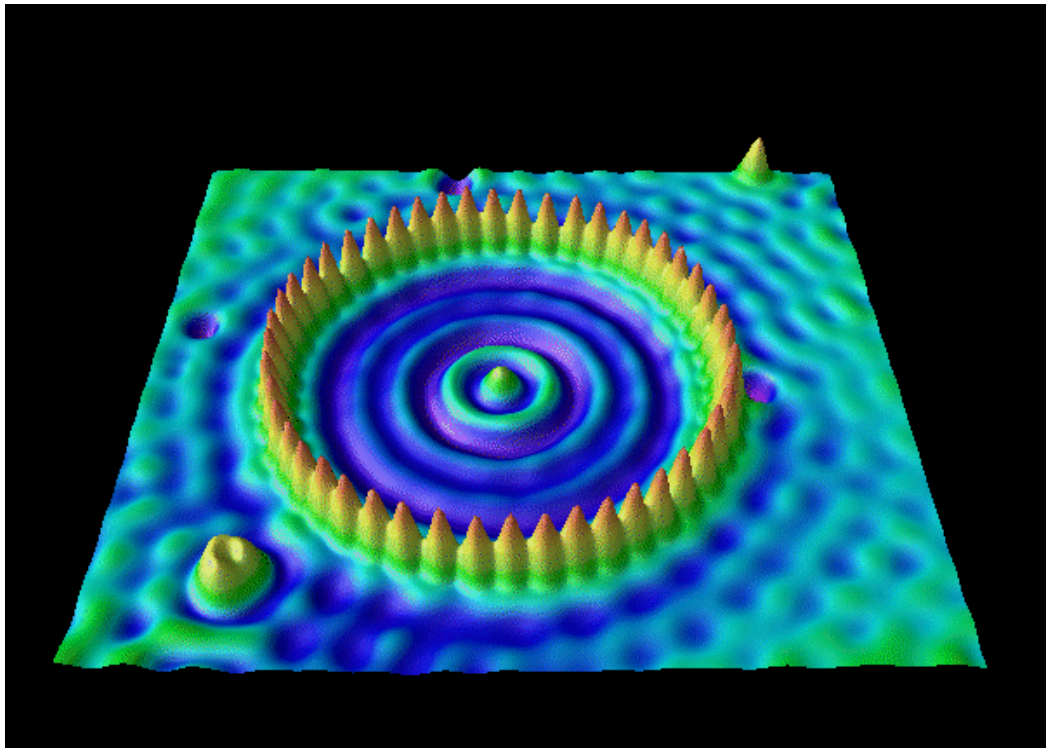
PhDs transplanted to universities

Affiliated colleges



INDUS-1

CERN

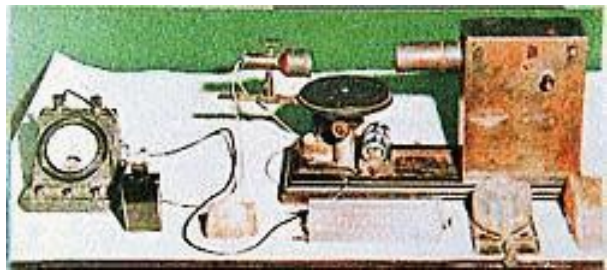


M. F. Crommie, C. P. Lutz and E. Eigler, *Science*, 262 (1993) 218.

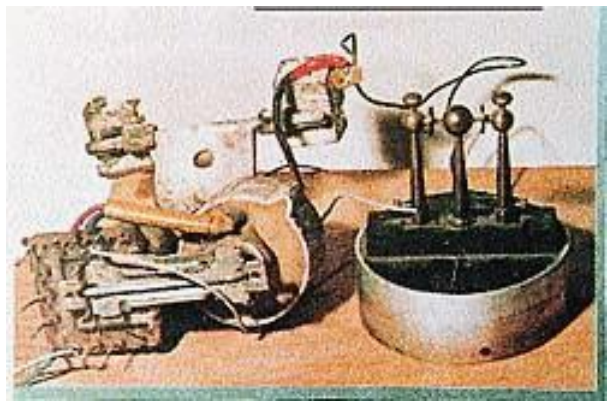
Infrastructure-limited research

Instrumentation in Indian research

J. C. Bose

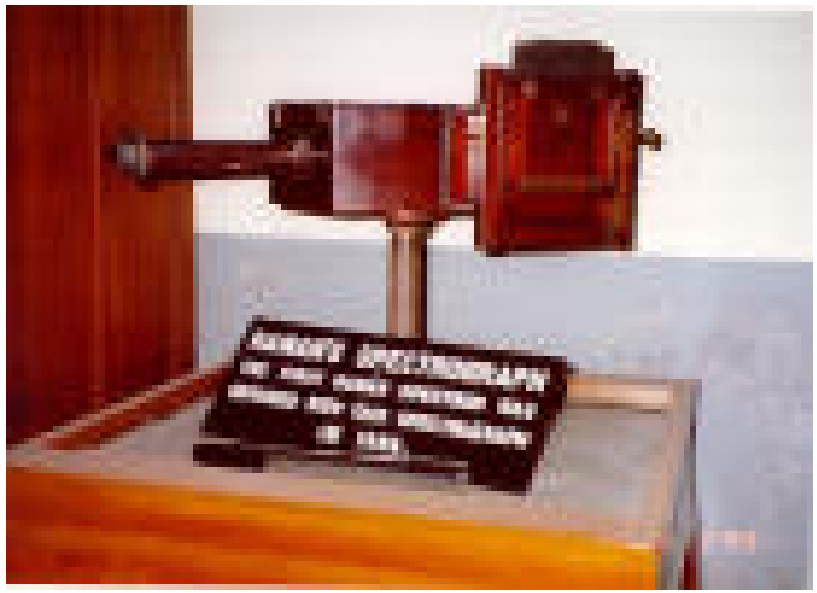


Microwave receiver



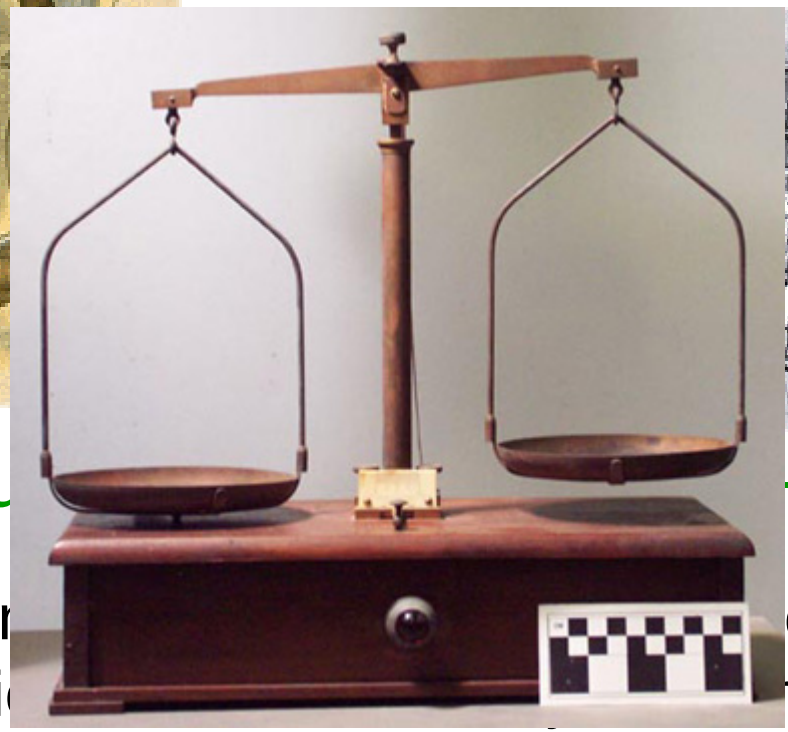
Microwave transmitter

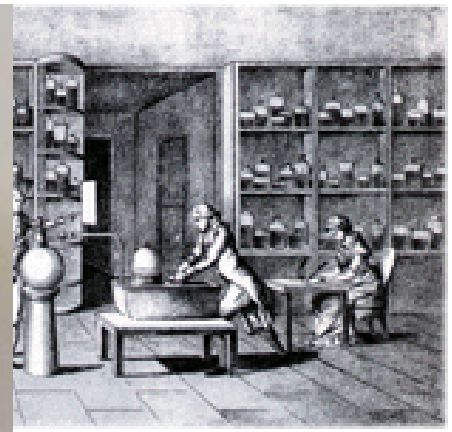
Plants have feeling



It did not take a lot to make it
but Raman could not have made his discovery without it

"Science is facts; just as houses are made of stones, so is science made of facts; but a pile of stones is not a house and a collection of facts is not necessarily science." **Henri Poincare**





Antoine-Lau –1794)

“Analysis and Syn of Oxides and Acids--Composit bustion--Respiration and Animal Heat--Permanence of Weight of Matter and Simple Substances- -Imponderable Nature of Heat and Its Role in Chemistry. “

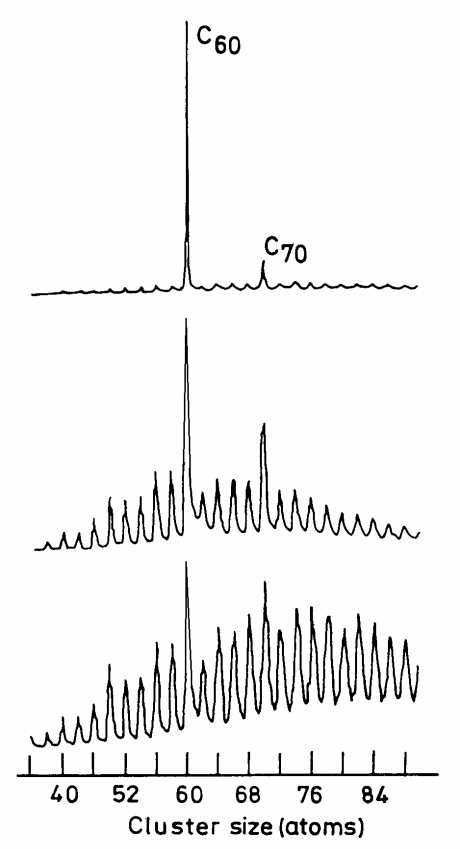
I consider the foregoing investigation as sufficient to prove the very extraordinary and important principle with respect to WATER, *that when subjected to the influence of the electric current, a quantity of it is decomposed exactly proportionate to the quantity of electricity which has passed*, notwithstanding the thousand variations in the conditions and circumstances under which it may at the time be placed....

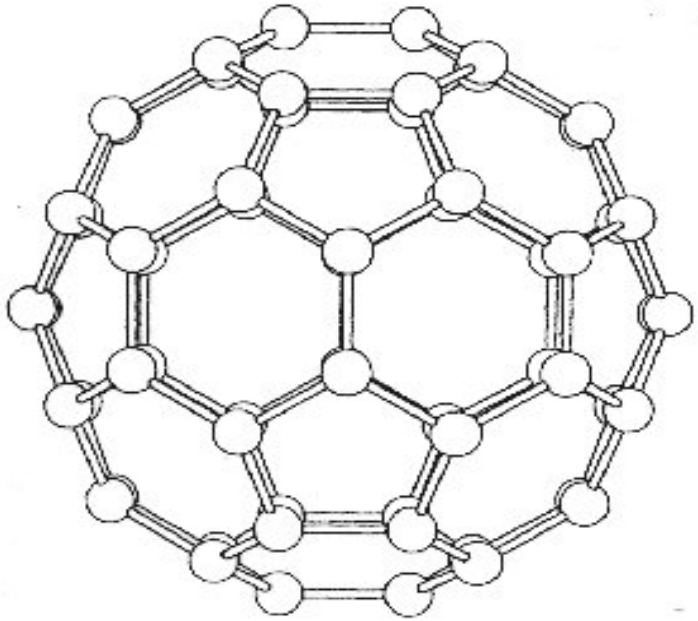
Michael Faraday, *Philosophical Transactions of the Royal Society*, 1834

The five essential entrepreneurial skills for success are concentration, discrimination, organization, innovation and communication

Inspiration - thought

Guernica April 26, 1937
Spanish Pavilion of the 1937 World's Fair





Kroto et al. *Nature* 1985

Structure of scientific communication

A New Type of Secondary Radiation

C. V. Raman and K. S. Krishnan, Nature, *121(3048)*, 501, March 31, 1928

If we assume that the X-ray scattering of the 'unmodified' type observed by Prof. Compton corresponds to the normal or average state of the atoms and molecules, while the 'modified' scattering of altered wave-length corresponds to their fluctuations from that state, it would follow that we should expect also in the case of ordinary light two types of scattering, one determined by the normal optical properties of the atoms or molecules, and another representing the effect of their fluctuations from their normal state. It accordingly becomes necessary to test whether this is actually the case. The experiments we have made have confirmed this anticipation, and shown that in every case in which light is scattered by the molecules in dust-free liquids or gases, the diffuse radiation of the ordinary kind, having the same wave-length as the incident beam, is accompanied by a modified scattered radiation of degraded frequency.

The new type of light scattering discovered by us naturally requires very powerful illumination for its observation. In our experiments, a beam of sunlight was converged successively by a telescope objective of 18 cm. aperture and 230 cm. focal length, and by a second lens was placed the scattering material, which is either a liquid (carefully purified by repeated distillation *in vacuo*) or its dust-free vapour. To detect the presence of a modified scattered radiation, the method of complementary light-filters was used. A blue-violet filter, when coupled with a yellow-green filter and placed in the incident light, completely extinguished the track of the light through the liquid or vapour. The reappearance of the track when the yellow filter is transferred to a place between it and the observer's eye is proof of the existence of a modified scattered radiation. Spectroscopic confirmation is also available.

Some sixty different common liquids have been examined in this way, and every one of them showed the effect in greater or less degree. That the effect is a true scattering, and secondly by its polarisation, which is in many cases quite strong and comparable with the polarisation of the ordinary scattering. The investigation is naturally much more difficult in the case of gases and vapours, owing to the excessive feebleness of the effect. Nevertheless, when the vapour is of sufficient density, for example with ether or amylene, the modified scattering is readily demonstrable.

Suggestions

On research

Always have a bag full of problems
Look at Everest and nothing less
Keep looking at ways to improve resources
Never be satisfied
Get it yesterday and not now or tomorrow

On communication

Be with masters
Present what you have to yourself
Write what you have, everything starts with a single step
Good to have role models, but not be like them
Look at details while looking at the whole