DR. RAJA RAMANNA
CHAIRMAN, GOVERNING COUNCIL
(Formerly, Chairman,
Atomic Energy Commission)

Dear Dr Bhawalkar,

"I was very happy to hear that the Centre for Advanced Technology is proposing to bring out a quarterly Newsletter about its activities.

As I recall, the Centre was started for the propagation of advanced Science and Technology in the State of Madhya Pradesh. The more information is available to the Universities and the public at large, the better it will be for the beautiful State of Madhya Pradesh to take up the leadership in these fields once again, as it did in the ancient past."

R. Ramanna

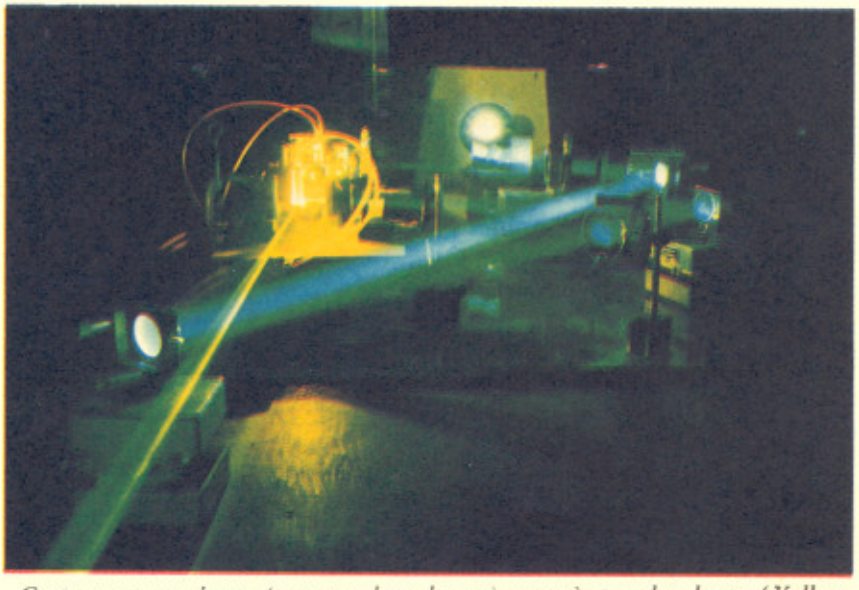
made of forged and machined material (Low carbon steel of magnet grade).

Laser Programme

Laser will rank amongst the most important inventionsof this century. During the last 25 years of its existence, laser has found applications in almost all areas of human endeavour. It has applications in medicine, industry, research and even in entertainment.

In India, work in lasers started way back in 1960s at BARC with the successful development of a semiconductor laser and an optical communication link over a distance of 20 kms. Work on several other lasers, namely helium-neon laser, carbon-di-oxide laser, Ruby laser, Nd: YAG and Nd: glass laser, Dye laser was taken up and several lasers were developed. Laser development reached a stage where it was felt that a major push in these areas was required. With this in mind, laser was taken up as a major area of technological thrust at CAT.

The laser activity at CAT can broadly be grouped into two major areas, viz. Laser fusion and Advanced Laser Technology. The Laser fusion work involves development of short duration, high power lasers using Nd: Glass oscillator and several amplifiers. The short intense laser pulses when focussed on any target, heat it to extremely high temperatures. Charactrization of the high temperature, high density plasma is essential to take up the study of laser plasma interaction. This work is presently being carried out at BARC and will be shifted to CAT after the laboratories are built. The work in Advanced Laser Technology includes work in the areas of tunable lasers, high power industrial laser, laser instrumentation and engineering and non-linear optics. The tunable laser programme involves developing a moderate power copper vapour laser and a dye laser. The most common types of lasers for industrial application are optically pumped Nd:YAG laser and electrical discharge multikilowatt CW CO_2 laser. The Nd: YAG laser is used for micromachining and the CO_2 laser is used for heavy duty material processing applications. Work on 25 Watt average power, 1 to 25 Hz Nd: YAG laser and 500 Watt CO_2 laser has started.



Copper vapour laser (green colour beam) pumping a dye laser (Yellow colour beam)

Ultrashort pulsed lasers permit studies of picosecond spectroscopy, nonlinear optical phenomena such as photon echo, phase conjugation with pico-second time resolution and transient phenomena. Study of nonlinear optical phenomena like optical phase conjugation, degenerate four wave mixing, optical bistability and related phenomena is being carried out.

The aim of Laser engineering and Instrumentation activity is to develop prototype models of different type of lasers developed under various R&D programmes and develop laser based instruments. These prototype instruments will then be made available for commercial production.

The laser activity at the Centre will also have a modern optical polishing and coating facility to meet the needs of various programmes.

In addition to the above major programmes, it is hoped that the Centre will also create a strong base in other related areas, viz. cryogenics, surface and material sciences, computer aided design and modelling, pulse power technology, high temp. technology, optical components and instruments, ultra high vaccum technology, radio-frequency systems, magnet technology, crystal technology, X-ray instrumentation etc. These technologies will also be useful to the space programme, defence, electronics and for development of alternative sources of energy.

सत्यमेव जयते

Dr. P. K. Iyengar
Member, Atomic Energy Commission and Director

भारत सरकार
GOVERNMENT OF INDIA
भाभा परमाणु अनुसंधान केन्द्र
BHABHA ATOMIC RESEARCH CENTRE

Dear Dr. Bhawalkar:

I am glad that the Centre for Advanced Technology is bringing out a Newsletter. This Centre is starting at an appropriate time when the country is catching up very fast with the advanced technology. The areas chosen for implementation at CAT will have wide application in many other areas of technology. It is, therefore, appropriate that the work that is being carried out at CAT is disseminated to as large a scientific and engineering community as possible. I hope this will in turn enthuse the scientists in CAT to perform at international level.

With regards,

Yours sincerely,

(P.K. Iyengar)

Achievements

1. Laser Instruments

A small nitrogen laser with active length of only 10 cm and giving peak power of 35 KW was developed. This laser was used to detect minute concentrations of uranium in water samples.

2. Tunable Laser

A copper vapour laser giving 10 Watts and 30 Watts average power at repetitive rate of 5-6 KHz was developed. The 30 W laser was sent to USSR in Festival of India Exhibition on science and Technology at Moscow and Tashkent. Two copper vapour lasers, one giving average power of 10 W and other 30 W were supplied to BARC.

3. INDUS-1

Basic design of INDUS-I has been completed and all parameters frozen. The design has been approved by a committee of experts appointed for this purpose. Design of dipole magnets for Booster ring is also complete and the magnets are under fabrication.

4. Cryogenics

Consultancy for the thermal system design required for 2m × 3m × 10m long chamber for testing missiles was given to High Altitude Test Facility for DRDL, Hyderabad and for a chamber 2m dia × 2.5m long to test the upper stage engine of the rocket was given to ISRO (VSSC, Mahendragiri, Trivandrum).

An ophthalmic cryoprobe (— 40°C) useful for surgical removal of cataract from the eye and a LN_2 cryoprobe for treatment of malignant tumors was developed.

A completely indigenous cryo-refrigerator working on Gifford-McMahon (G-M) cycle and producing a temperature of 20°K has been developed.

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