INDIAN INSTITUTE OF ASTROPHYSICS

Annual Report

Koramangala - Bangalore-34
INDIA

INDIAN INSTITUTE OF ASTROPHYSICS

BANGALORE - 560034

REPORT FOR THE YEAR 1982-83

INTRODUCTION

The Indian Institute of Astrophysics, the national centre for research in Astronomy and Astrophysics is the successor of the oldest surviving scientific institution in India. The observatory, established by the East India Company in 1792 had already established its fame in Astronomical research, when in 1899, it was taken over by the Government of India and amalgamated with the newly formed Meteorological Department. In 1971 on the advice of a Review Committee it was formed into an autonomous research Institute under the Ministry of Civil Aviation. The Institute carries on research and development work on all branches of Astrophysics, with special emphasis on observational work by telescopes and associated instruments from ground based locations.

During the current year, several important steps of advancement could be achieved by the Institute. These are detailed in the following few paragraphs. In the field of instrumentation the highlights consist of bringing the 234 cm telescope project nearer to completion, in developing the

new faint image detection system and in introduction of several vital modifications in the observing equipment. The observations recorded with our telescopes have given new information about the structure of our galaxy and about the physical processes occurring in certain types of variable stars.

ORGANISATION

The research and development activities of the Indian Institute of Astrophysics are carried out in four main locations in the country as illustrated in Appendix.I.

The Institute is governed by a Governing Council of eight members appointed by the Central Government. Along with senior official nominees of the Government, the Council consists of leading scientists in the country. The council supervises and approves scientific and administrative policy matters relating to the work of the Institute. The implementation of the policies is done by Director, with the help of a team of scientific, technical and administrative personnel. The organisational chart is shown in Appendix-II.

The staff strength in the beginning of the year was 2 90. During the year 9 persons joined the Institute and 11 left. The total strength on 1.12.1982 is 288 of which 33 belong to the Academic category, 162 in the Technical and 93 in Administrative and supporting services.

MAJOR SCIENTIFIC ACTIVITIES

Major activities and achievements during the year are briefly described in this chapter.

1. 234 Cm Telescope Project

Manufacture of majority of the components for fabrication of the telescope mount has been completed; a portion of the giant horse-shoe has been sent to the bearing manufacturer for profile matching on the oil-pad bearing. The assembly operation at the workshop at Walchandnagar will begin on receipt of these special bearings shortly. The large aluminizing chamber has been installed at Kavalur and trial operations of various movements of the dome have started. The fabrication of the console housings has been completed at the workshops of the Bhabha Atomic Research Centre, Bombay. In the design and proto type manufacture of control and display circuits about 60% progress has already been achieved. The process of fabrication of final printed circuit boards has also commenced.

The figuring work on the primary 234 cm parabolic mirror has advanced considerably; the measurements on the surface indicate that it is now very close to the final design figure. The work on secondaries and other auxiliary optics has been taken up.

2. Instrumentation

A faint image detection system employing a 4-stage image intensifier and a two-dimensional CCD-array was fabricated and tested under laboratory conditions. The design has several novel features, and is extremely versatile in catering to the varying needs of astronomical image detection and spectroscopy. Based on the experience of the laboratory trials, a new cryogenic chamber has been designed and is under fabrication.

Work on the construction of a Fourier Transform Spectrometer was continued after testing the prototype with laboratory sources. A new polarimeter, for measurement of polorization of star light was designed and constructed and is proposed to be put into use during the current observing season. Two modified versions of coded photo-multiplier photometer arrangement were introduced in observations.

An automated arrangement for testing large concave surfaces using two crossed Babinet compensators was designed and work on its fabrication started. A semi automatic procedure based on this principle has been adopted for testing the various mirrors produced in our optical workshop.

3. PHYSICS OF SUN, STARS AND THE INTERSTELLAR MEDIUM

Observational and theoretical studies in this broad field of research were continued. By using a method developed here, the riddle of two classes of hot stars known as the peculiar A-type(Ap) and metallic A-type (Am) were investigated. Analysis reveals that Ap stars have diameters comparable to slightly evolved normal A-stars, while Am stars have diameters merging with cooler A stars. Significance of this finding in relation to the peculiar properties of these stars are being investigated.

Normally it is seen that RR Lyrae type variable stars have periods proportional to their sizes; an analysis of these type stars in globular clusters has shown that the relation is reversed; further analysis in these field is being continued.

Some stars show emission spectra owing to peculiar formation in their atmosphere; it is believed that accretion of matter from interstellar space plays a significant role in this process. A series of observations of stars in rich nebulous regions has been taken up to determine the nature of this process.

Supernova explosions are rare phenomena in any individual galaxy, but when we study distant galaxies the chances of seeing supernova explosions are good. In a study undertaken by one of our groups it is seen that the distant elliptical galaxies which have shown a supernova explosion in the near past are bluer and more metal rich than those in which no supernova explosions have occurred. The finding is significant and may explain the physics of these explosions.

The question whether other stars have activity cycles like our sun has been troubling the minds of many scientists, but no direct way of investigating the possibility has yet been discovered. One indirect way is to deduce such activity from studying the emissions due to ionised calcium atoms. To establish the reliability of this method, a series of controlled observations of the sun have been taken at Kodaikanal and the data are being analysed. The results will be of great interest in stellar research.

The growth of magnetic fields in solar active regions have been the subject of study both from observational and theoretical angles. As more detailed observations are

being collected from the solar telescopes at Kodaikanal, complex mathematical models are being worked out which may explain the growth, decay and activity of sunspot regions.

4. STUDIES OF THE SOLAR SYSTEM

Arrangements for observation of comet Halley during its forthcoming apparition in late 1985-86 are made by drawing up plans for new instrumentation, observation and methods of analysis. Co-operation with "International Halley Watch", a concerted move by scientists all over the world has been a major step in this programme.

Analysing the light curves obtained during the occultation of stars by Uranus over the past four years has revealed an important feature of its ring. It has been found that this feature has a twisted structure like the F-ring of Saturn.

5. SOLAR TERRESTRIAL PHYSICS

Effects of the particle streams from the sun on the earth's equatorial magnetic field are being investigated in detail. Some of the peculiar behaviours of the

equatorial ionosphere like scattered echoes from the F-region have also been studied by employing new experimental arrangement. Good progress was achieved in the HF coherent phase path sounder fabrication and the equipment was put on trial run.

6. GALACTIC SYSTEMS AND HIGH ENERGY PHENOMENA

On the basis of Conformal Gravity QSO models, theoretical attempts to derive occurrence of QSO pairs and triplets have been made. The association of QSOs with galaxies appears to be real on the basis of new observational results.

Effect of dynamical friction on oscillatory motion of massive black holes was theretically investigated. The aim of the investigation is to judge the possibility of distortions in galactic nuclear as a result of ejecting black holes.

More exact formulation of the nuclear processes involved in the collapse of massive stars have been worked out by our scientists. The results point to a new and promising explanation for observed supernova explosions.

A recent intriguing problem in cosmic-ray astronomy is the observation of an excess of low energy galactic anti protons, whereas the usual theory predicts the

reverse. In one investigation undertaken by the scientists of this institute, the phenomenon of neutron-antineutron oscillations predicted by the Grant Unified theories has been invoked and the discrepancy partially resolved.

GENERAL ACTIVITIES

Dr.M.K.V.Bappu, Director of the Institute, who was associated with us for the past twenty one years and had guided its activities to scientific excellence, passed away after a heart operation in August 1982. He was instrumental not only in the development of the Institute as an autonomous research institution but also in the revival of astronomical activities in India. He was the current President of the International Astronomical Union at the time of his death. It is a sad blow to the nation's aspirations in the filed of astronomy.

27 members of the Academic and technical staff were sent on deputation to attend national and international conferences and seminars. The XVIII General Assembly of the IAU at Patras, Greece and its associated symposia and colloquia were attended by Scientists of the Institute who undertook major roles in the activities.

47 scientific papers were published by the Scientists of the Institute during th year.

Training programme of the Institute for post graduate, research students were continued during the year. Two students of the Institute submitted their thesis for the Ph.D degree at two universities in India. The Institute also participated in a special training programme launched by Indian Institute of Science, Bangalore by pooling resources of five major scientific Institutes in the country.

5 Scientists from foreign countries visited the Institute and participated in the research and training programmes of the Institute.

FINANCE

The financial position of the Institute is illustrated in Appendix-III. The Institute is totally supported by Grants-in-aid received from the Central Government. Major areas of research are covered by projects financed under the Five Year Plans, while routine scientific activities are covered by grants-in-aid under the Ministry's non-Plan expenditure.

SERVICE TO SCHEDULED CASTE/SCHEDULED TRIBE

Special efforts towards attracting members of SC/ST towards research in Astronomy and Astrophysics were continued. Out of the 288 filled positions in this Institute 37 persons belong to the Scheduled caste and 6 persons belong to Scheduled tribe representing 13% and 2% respectively.

USE OF HINDI IN OFFICIAL CORRESPONDENCE

The efforts of this Institute in the use of Hindi was bolstered with the additions of a qualified person for translation and teaching work in Hindi. After meeting the requirements in this programme laid down in the Offical Languages Act, it is proposed to take up translation of popular articles brought out by the scientists of the Institute into colloquial Hindi.

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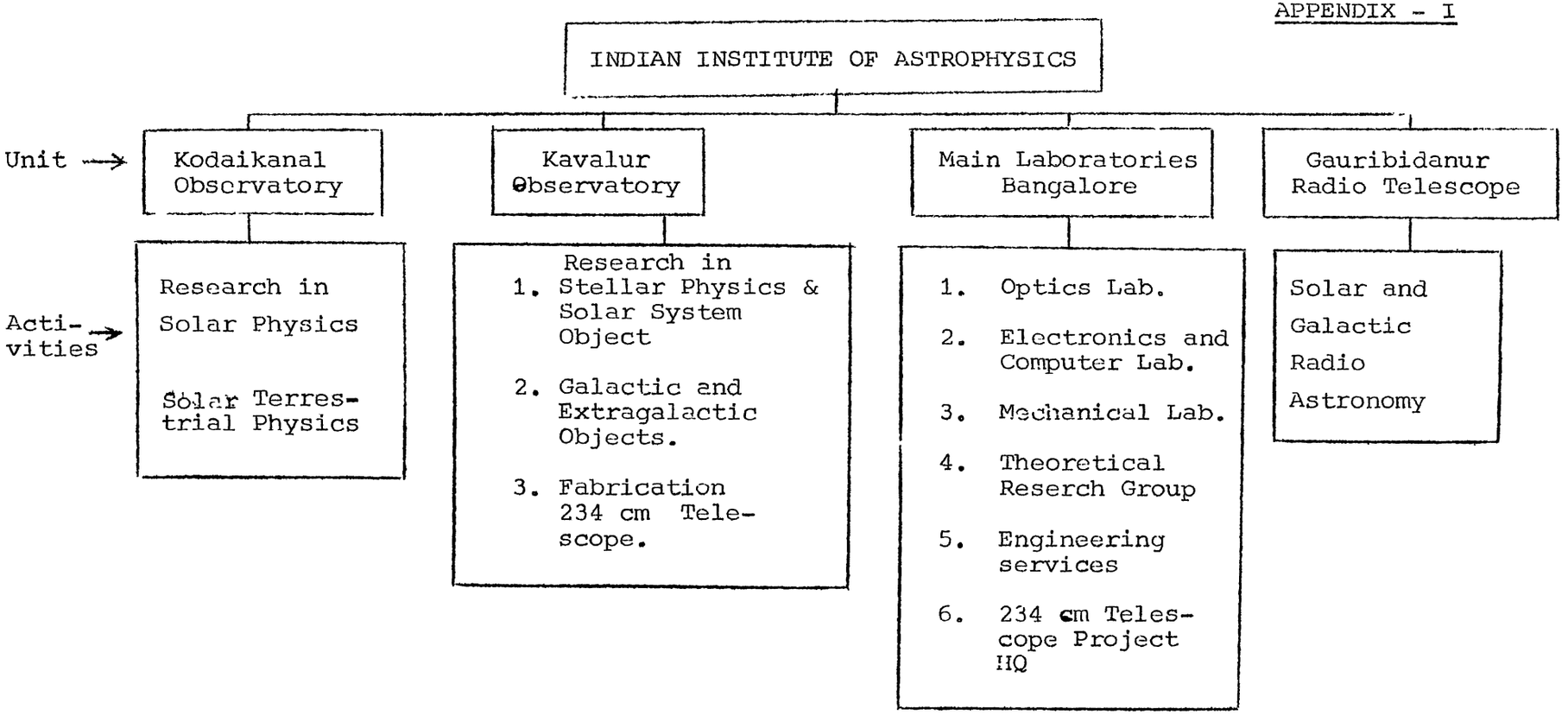
APPENDIX - I


INDIAN INSTITUTE OF ASTROPHYSICS
Unit
Kodaikanal Observatory
Kavalur Observatory
Main Laboratories Bangalore
Gauribidanur Radio Telescope
Acti-vities
Research in
Solar Physics
Solar Terrestrial Physics
Research in
1. Stellar Physics & Solar System Object
2. Galactic and Extragalactic Objects.
3. Fabrication 234 cm Telescope.
1. Optics Lab.
2. Electronics and Computer Lab.
3. Mechanical Lab.
4. Theoretical Reserch Group
5. Engineering services
6. 234 cm Telescope Project HQ
Solar and
Galactic
Radio
Astronomy

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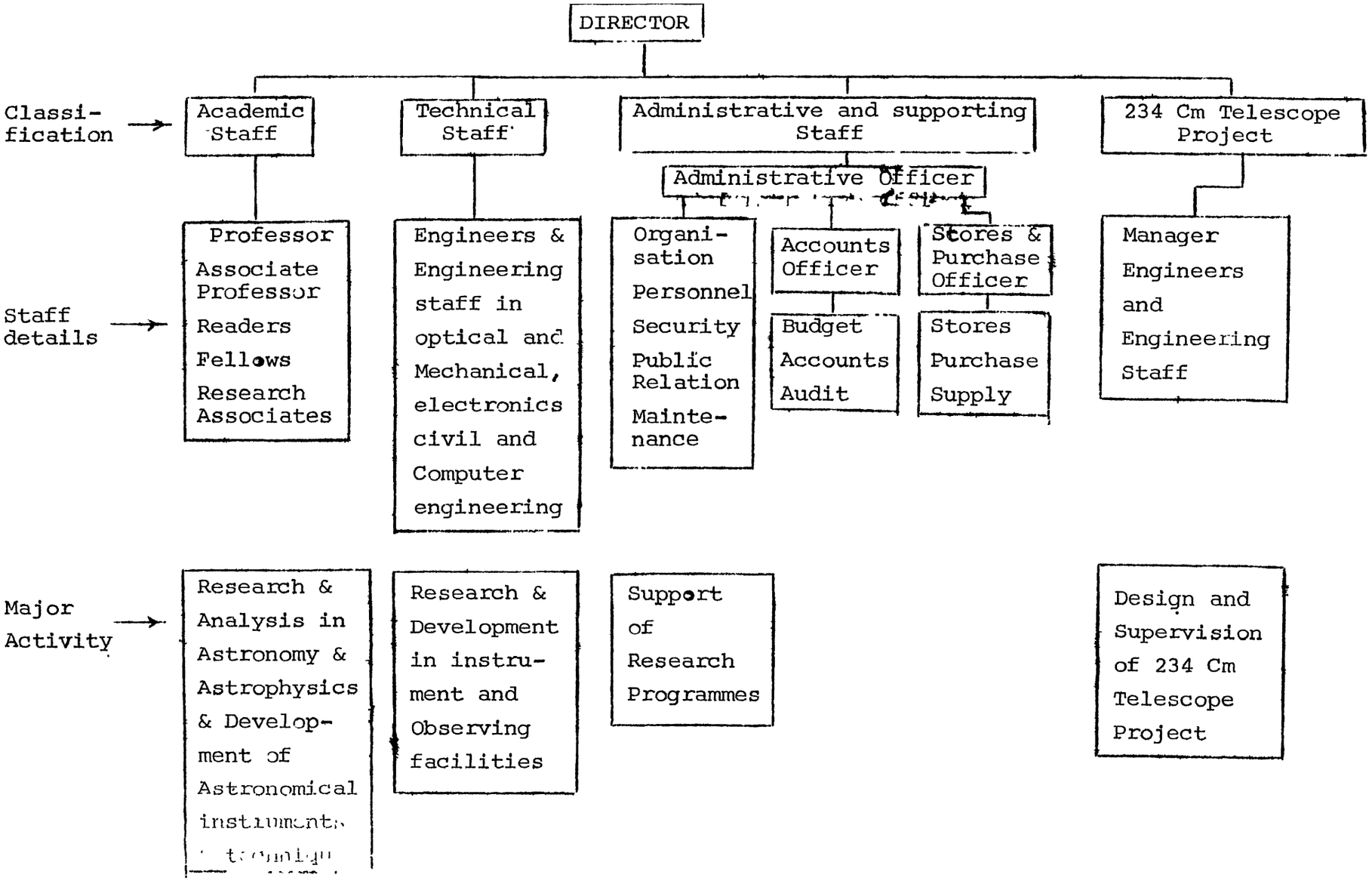
DIRECTOR
Classi-fication
Academic Staff
Technical Staff
Administrative and supporting Staff
234 Cm Telescope Project
Administrative Officer
Staff details
Professor
Associate Professor
Readers
Fellows
Research Associates
Engineers & Engineering staff in optical and Mechanical, electronics civil and Computer engineering
Organi-sation
Personnel
Security
Public Relation
Mainte-nance
Accounts Officer
Budget
Accounts
Audit
Stores & Purchase Officer
Stores
Purchase
Supply
Manager
Engineers
and
Engineering
Staff
Major Activity
Research & Analysis in Astronomy & Astrophysics & Develop-ment of Astronomical
Research & Development in instru-ment and Observing facilities
Support of Research Programmes
Design and Supervision of 234 Cm Telescope Project

APPENDIX - III

PLAN

Statement showing actual expenditure incurred upto September 1982 against the Annual Plan outlay approved for the year 1982-83.

Heads	Approved outlay 1982-83	Revised Estimate approved by G.C & Fin. Committee 1982-83	Actual expenditure April 1982 to September 1982
A. Revenue Expenditure			
1) Salaries & allowances	17,50,000	18,80,000	8,83,957
2) Operational Expenses	7,50,000	8,00,000	3,52,171
B. Capital Expenditure			
1) Capital Equipment	102,00,000	122,50,000	13,22,201
2) Capital works	10,00,000	15,00,000	10,21,272
	137,00,000	164,30,000	35,79,601

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