

RAMAN RESEARCH INSTITUTE

REPORT FOR THE YEAR 1972 -73

The direction of the Institute was taken up in May 1972 by Prof. V. Radhakrishnan on his return to India. Until then Dr. Ramaseshan had been looking after the affairs of the Institute since July 1971. The year 1972-73 witnessed the picking up of momentum in the Institute's research activity and in the setting up of facilities for research. A number of researchers joined the research groups and a large number of instruments and pieces of equipment were procured or ordered for.

Liquid Crystal Group

(1) The renovation of the old building to house the Liquid Crystal Laboratory was completed except for the Chemistry Laboratory Wing, work on which was progressing. It was possible during the year to initiate some experimental activity in the study of the physical properties of liquid crystals. Facilities have been set up for work in Optical, X-ray, NQR, Electric, Magnetic and Pressure studies (the last in collaboration with the Material Sciences Division of the National Aeronautical Laboratory, Bangalore). Some of these techniques have already yielded fruitful results. In addition theoretical investigations on (1) Theory of the nematic state (2) Theory of the optical properties of cholesteric liquid crystals in the previous year are continuing.

(ii) C.S.I.R. Silver Jubilee Award: It is a matter of pride that Prof. Chandrasekhar, Head of our Liquid Crystals Laboratory was the recipient of the CSIR Silver Jubilee Award for his pioneering work on Liquid Crystals. The award is in the amount of Rs.1 to 1.25 lakhs per year tenable for a period of 4 to 5 years.

(iii) N.C.S.T. Project on Liquid Crystal Devices: Work was in progress on the development of Liquid Crystal display devices under a project sponsored by NCST. A 7-segment Alpha Numeric Digital Display has been designed. This was examined by Bharat Electronics Ltd. and found to be acceptable for use in certain types of instruments. The RRI group is now working in close collaboration with BEL for the manufacture of these devices on a large scale. An addressing system (direct and multiplexed) is under development and it is hoped to have a complete working multidigit device by the end of 1973.

Members of the group were invited to participate in the following:

1. Seminar on 'Unsolved Problems in Physics'. Centre for Theoretical Studies, Indian Institute of Science, Bangalore - July 1972.
(Paper presented: Orientational Short Range Order in Liquids)
2. Fourth International Liquid Crystals Conference, Kent, Ohio, USA - August 1972
(Paper Presented: Generalization of the Maier-Saupe Theory)
3. Seminar on 'The General Many Body Problem' Physical Research Laboratory, Ahmedabad - March 1973
(Paper presented: Liquid Crystals)
4. Seminar on 'Ordered Fluids and Liquid Crystals' at the National Meeting of the American Chemical Society to be held in Chicago, August 1973
(Paper to be presented: 'Kerr Effect in the Isotropic phase of p-Azoxyanisole')

Cosmic Physics Group

(i) The group started its activities with two research fellows and one research assistant who joined during the year. A visiting scientist formerly of the University of Sydney, Australia joined them in March 1973. Pending repairs to the T.I.F.R. Radio Telescope at Ooty, which the group will be using, the main activity has been a training programme in Radio Astronomy. The method followed has been to hold lectures on all aspects of Radio Astronomy followed by intensive discussion and clarification. Twenty nine sessions were held in 1972-73 dealing with mechanisms of radio emission; radio telescopes and interferometers; cosmology; coherence; inter-stellar molecular spectroscopy and various aspects of electronics. All members of the Cosmic Physics Group and many others took part in both lecturing and discussing.

A number of experiments in electronics designed to illustrate those aspects of relevance to Radio Astronomy were also organised in the laboratory.

(ii) Collaboration with Indian Institute of Astrophysics, Kodaikanal

Collaboration at the discussion level already existing with the Indian Institute of Astrophysics, Kodaikanal was extended to the practical level with the movement of their electronic and optical grinding sections to this Institute during the year. Members of the two institutes are now working in close collaboration on problems of mutual interest.

Theoretical Physics Group

While a number of appointments have been made of members to the Theoretical Physics Group, only one actually joined during the year 1972-73. It is expected that this group will really start functioning towards the middle of the next financial year.

Collaboration with other research establishments in Bangalore

Co-operation extended by the Indian Institute of Science and the National Aeronautical Laboratory has helped in no small measure to augment the facilities available at this Institute.

Prof. Radhakrishnan was invited to be an honorary visiting professor at the Indian Institute of Science and accepted the offer. Prof. Dhawan, Director of the Indian Institute of Science arranged for all the major facilities of the Institute (accommodation for visiting scientists in the guest house and hostel, medical facilities use of library, computer, gymkhana and staff club, school bus, swimming pool, music room, etc.) to be made available as freely to members of RRI as to those of his own Institute. Various services available at NAL have similarly been extended to us by the Director Dr. Valluri and the Institute has gratefully availed itself of these benefits whenever necessary. Collaborating with the two institutions in research projects was an important feature of this year's activities.

Library:

Re-organisation of the Library and Documentation service in the Institute picked up momentum with the appointment of a Librarian. All the holdings - about 7600 books and 12,800 bound volumes of journals - were accessioned. The Bangalore Regional Centre of the Indian National Scientific Documentation Centre completed compilation of a Union Catalogue of the periodicals holding of the library and the catalogue is under print. About 50 journals were being subscribed to during the year in addition to about 350 being received by courtesy of the Indian Academy of Sciences and the Current Science Association.

Visiting Scientists

A number of outstanding scientists visited the Institute during the year. Members of the Institute were immensely benefited by the lectures given by the visiting scientists and by discussions with them. Many of the visiting scientists may be identified in the list of colloquia held during the year, at Annexure I.

Publications

A list of publications from the Institute may be seen at Annexure II.

Buildings

Shortage of office space and laboratory facilities posed problems which could not be tackled easily. As already stated elsewhere, renovation of the Liquid Crystal Laboratory was completed except for the Chemistry wing. Modifications to the existing facilities in the main Institute building and the old Spectroscopic Laboratory were in progress. The constant search for non-existent working space makes it increasingly urgent to commence some of our building programmes, if the expansion schemes of the Institute are not to be stifled.

Acquisition of Land

The possibility of getting some land in the Palace Grounds adjoining the Institute for construction of additional buildings was explored with the Government of Mysore with the help of Prof. S. Dhawan. In case of failure of this attempt, enquiries for alternative sites were also made. These have revealed the availability of some land belonging to IBM some three miles from the Institute. The possibility of acquiring this land is being investigated.

V Five Year Plan Proposals

Financial requirements relating to the V Five Year Plan of the Institute were revised on the recommendation of the Expert Committee which considered the proposals at a meeting held in the Department of Science & Technology on 27th December, 1972.

International Conference on Liquid Crystals

Arrangements to hold an International Liquid Crystal Conference and a Winter School preceding it during November-December 1973 to mark the Silver Jubilee of the Institute was under way. About 40 distinguished scientists from overseas and an equal number from various research establishments within the country are expected to participate in this Conference.

Administration

The general administrative services of the Institute including purchase, stores and civil engineering were organised with the joining of an Administrative Officer and Civil Engineer.

Some of the important items of equipment procured during the year are given in Annexure III

Finance

The following grant was received from the Government during the year.

Recurring	Rs.5.42 lakhs
Non-recurring	Rs.10.42 lakhs.

A copy of the audited statement of receipts and payments for the year 1972-73 is at Annexure IV.

ANNEXURE IList of Colloquia held at the Institute

<u>Date</u>	<u>Name of the speaker</u>	<u>Title of the lecture</u>
1972		
24th June	Prof. G.W.Series, FRS University of Reading, England	Experimental & Theoretical work by S.Pancharathnam on Optical Pumping in Atomic Vapours.
11th July	Dr.P.M. Goldreich California Institute of Tech. Pasadena, Calif. USA	Spin-Orbit Coupling in the Motion of the Planets.
3rd Aug.	Dr.J.G.Ables Commonwealth Scientific & Industrial Res. Organisation Sydney, Australia.	Fourier Spectral Analysis and the Use of the Maximum Entropy Method.
14th Aug.	Prof. W.N.Christiansen Dept. of Elec. Engg. University of Sydney, N.S.W. Australia	High Resolution Techniques in Radio Astronomy.
24th Aug.	Prof. E.C.G. Sudarshan Centre for Particle Theory University of Texas at Austin and Centre for Theoretical Studies, Indian Institute of Science, Bangalore	High Energy Physics
5th Sept.	Dr.R. Cowsik (TIFR, Bombay) Deptt. of Physics University of California in Berkeley.	Rest Mass of the Neutrino and its Astrophysical implications.
14th Sept.	Prof. P. Hariharan Central Instruments & Service Laboratory Indian Inst. of Science, Bangalore	Photographic Phase Holograms
18th Sept.	Dr. C.A. Croxton Jesus College, Cambridge England	Statistical Mechanics of classical Liquid Surface.
19th Sept.	- do -	Surface Structure of the Strongly coupled Boson fluid.
21st Sept.	- do -	Solid Fluid Phase Transition: A diagrammatic Approach

ANNEXURE -IIList of Research Publications

1. Spectroscopy of Liquid Crystals - S. Chandrasekhar and N.V.Madhusudana - Applied Spectroscopy Reviews 6, 189-311, 1972
2. Short Range Orientational Order in the Isotropic Phase of Nematic Liquid Crystals - N.V.Madhusudana and S.Chandrasekhar Solid State Communication (in press)
3. Nematic Order in p-Azoxyanisole and its Dependence on Pressure, Volume and Temperature - S. Chandrasekhar and N.V.Madhusudana - Mol. Cryst. and Liq. Cryst. (in press)
4. Some Electrohydrodynamic Distortion Patterns in a Nematic Liquid Crystal - N.V.Madhusudana, P.P.Karat and S.Chandrasekhar - Current Science, 42(5), 147, 1973.
5. Theory of the Optical Properties of Non-Absorbing Compensated Cholesteric Liquid Crystals - S. Chandrasekhar, G.S.Ranganath, U.D.Kini and K.A.Suresh - Mol. Cryst. and Liq. Cryst.(in press)
6. Optical Properties of Mixtures of Right-Handed and Left-Handed Cholesteric Liquid Crystals - G.S.Ranganath, S.Chandrasekhar, U.D.Kini, K.A.Suresh and S.Ramaseshan - Chemical Physics Letters 19(4), 556, 1973.
7. Magnetic and Electric Birefringence in the Isotropic Phase of Nematic Liquid Crystals - N.V.Madhusudana and S.Chandrasekhar - PRAMANA (in press)

Major items of equipment procured/ordered during 1972-73

<u>Sl. No.</u>	<u>Description</u>	<u>Qty.</u>	<u>Approx. cost</u> <u>Rs.</u>
1	'Philips' D.C. Micro-voltmeters	2	9,300
2	'Digilog' Millivolt adapter	1	3,100
3	Aplab 15 MHz Digital Time Frequency counter	1	15,200
4	Electrometer Amplifier	1	5,000
5	A.C. Geared motors	3	1,600
6	Standard Cells	2	600
7	Industrial Vacuum Cleaner	1	2,800
8	Microheating table with special microscope	1	4,900
9	"Toshniwal" Regavolts	2	950
10	BDS Type M 3010 stabilized power supply	1	3,900
11	"Hind Hivac" coating unit	1	55,500
12	Avometer, Model 8X	1	1,000
13	'Toshniwal' Polyflex Galvanometer	1	1,700
14	'Systronics' Low Distortion R.C. Oscillator	1	2,100
15	'Systronics' A.C. Microvoltmeters	2	6,000
16	Electronic Desk Calculator	1	7,600
17	'Toshniwal' Constant Temp. Bath	1	4,300
18	Heating Mantles	5	2,000
19	'Motwane' Multimeters	2	1,400
20	'AIMIL' Turret type 30 speed gear box	1	3,000
21	'Systronics' Cathode Ray Oscilloscope	1	11,900
22	'Digiweld-12' Controlled Energy Portable Resistance Welder	1	5,100
23	Magnetic Stirrer with hot plate	2	1,100
24	Waveform Generator 0.003 Hz to 3 MHz	1	8,300
25	Electronic Multimeter, AC & DC ranges	1	1,900
26	Regulated Power Supplies	5	5,000

Annexure I (contd.)

<u>Sl. No.</u>	<u>Description</u>	<u>Qty.</u>	<u>Approx. cost</u> Rs.
27	Tong Tester Ammeter	1	900
28	'Toshniwal' Multimantles	2	700
29	Analytical Semi-micro Balance	1	4,300
30	'Digilog' Strip Chart Recorder & Millivolt adapter	1	12,000
31	Rheostats	3	600
32	Gaussmeters	3	3,500
33	Research Electro-magnet	1	53,000
34	'Polytec' FIR-30 System for the far infrared	1	9,00,000

Dr.

Cr.

Rs.

Rs.

P.6 Maintenance	11,620.41
P.7(1) Minor apparatus & Equipment	7,700.78
P.7(2) Chemicals	4,009.73
P.7(3) Workshop Stores	6,900.87
P.7(4) (i) Misc. non-consumable Stores	5,162.33
(ii) Misc. Consumable Stores	1,34,000.70
Advances	4,474.10
Earnest Money	
Deposits refund	<u>925.00</u>
	5,52,450.47

II. NON-RECURRING

P.5(1) Works	49,802.62
P.5(2) Services	13,005.24
P.5(3) Capital Equipment	9,33,621.20
P.5(4) (i) Furniture	13,195.82
P.5(4) (ii) Books and Journals	<u>32,167.67</u>
	10,41,792.55

Closing Balance

15,94,975.37

15,94,975.37

EXAMINED AND FOUND CORRECT
 Sd/- Sankaran & Raman
 Chartered Accountants

CERTIFIED THAT THE ABOVE STATEMENT IS
 CORRECT
 Sd/-
 Administrative Officer

Bangalore
 23.5.1973