IUCAA 1990-91

Annual Report
of the
Inter-University Centre for Astronomy and Astrophysics

(April 1, 1990 — March 31, 1991)

Edited by
Pramila A. Malegaonkar

Cover: Pseudocolour representation of a surface fit to a CCD flat field taken at the Vainu Bappu Telescope.

Design + Print: Mudra

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The Council and the Governing Body

The Council

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Yash Pal (till March 6, 1991)
Chairman,
University Grants Commission

Manmohan Singh (from March 15, 1991)
Chairman,
University Grants Commission

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S.K. Khanna (till June 27, 1990)
Secretary,
University Grants Commission

S.C. Gupte
Vice-Chancellor, University of Poona

G. Swarup
Director, NCRA, Pune

S.P. Gupta (from June 28, 1990 to
February 27, 1991)
(Officiating) Secretary,
University Grants Commission

Y.N. Chaturvedi
(from February 28, 1991)
Secretary,
University Grants Commission

M. Bhattacharya
Vice-Chancellor,
University of Burdwan

M. Lakshmanan
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T. Navaneeth Rao
Vice-Chancellor, Osmania University

U. Baxi
Vice-Chancellor, University of Delhi

R.P. Bambah (till December 29, 1990)
Vice-Chancellor, Panjab University

M.M. Laloraya (till December 29, 1990)
Vice-Chancellor,
Ravishankar University

Satchidanand Sinha
(till December 29, 1990)
Vice-Chancellor, Rajasthan University

K.N. Chatterjee (from January 1, 1991)
Vice-Chancellor,
North Bengal University

Dilavarsingh D. Jadeja
(from January 1, 1991)
Vice-Chancellor,
Sardar Patel University

H.K. Manmohan Singh
(from January 1, 1991)
Vice-Chancellor, Punjabi University

K.D. Abhyankar
Emeritus Professor,
Osmania University

A. Banerjee
Department of Physics,
Jadavpur University

N. Mukunda
Indian Institute of Science, Bangalore

Archana Sharma
Department of Botany,
Calcutta University

A.N. Mitra (till December 29, 1990)
Department of Physics,
University of Delhi

S.D. Verma (till December 29, 1990)
Department of Physics,
Gujarat University

	P.M. Mathews (from January 1, 1991) Department of Theoretical Physics, University of Madras
	R.K. Thakur (from January 1, 1991) Department of Physics, Ravishankar University
	S.K. Trehan (from January 1, 1991) Centre for Advanced Study in Mathematics, Panjab University
Member Secretary	J.V. Narlikar Director, IUCAA

The Governing Body

Chairman	Yash Pal (till March 6, 1991) Manmohan Singh (from March 15, 1991)
Vice-Chairman	S.K. Khanna (from June 28, 1990)
Members	K.D. Abhyankar U. Baxi M. Bhattacharya S.C. Gupte S.K. Khanna (till June 27, 1990) S.P. Gupta (June 28, 1990 to February 27, 1991) Y.N. Chaturvedi (from February 28, 1991) N. Mukunda T. Navaneeth Rao Archana Sharma G. Swarup
Member Secretary	J.V. Narlikar

Honorary Fellows

1. S. Chandrasekhar
   University of Chicago

2. W.A. Fowler
   California Institute of Technology

3. A. Hewish
   University of Cambridge

4. Sir Fred Hoyle
   St. John's College, Cambridge

5. D.S. Kothari
   New Delhi

6. A. Salam
   International Centre for
   Theoretical Physics, Trieste

Statutory Committees

The Scientific Advisory Committee

1. J. Audouze
   Institut d'Astrophysique, Paris
2. G. Burbidge
   University of California at San Diego
3. J.V. Narlikar
   Director, IUCAA
4. V. Radhakrishnan
   Raman Research Institute, Bangalore
5. M. Rees
   Institute of Astronomy, Cambridge
6. N.V.G. Sarma
   Raman Research Institute, Bangalore
7. J. Wampler
   European Southern Observatory,
   Garching (till October 1990)

The Finance Committee

1. Yash Pal (Chairman, till March 6, 1991)
   Manmohan Singh
   (Chairman, from March 15, 1991)
2. S.K. Khanna
3. A.K. Mathur
4. Y.N. Chaturvedi
5. J.V. Narlikar
6. T. Sahay (Non-Member Secretary)

The Academic Programmes Committee

1. J.V. Narlikar (Chairman)
2. N.K. Dadhich
3. A.K. Kembhavi
4. S.V. Dhurandhar (Secretary)

The Standing Committee for Administration

1. J.V. Narlikar (Chairman)
2. T. Sahay (Secretary)

Members of IUCAA

Academic Staff

J.V. Narlikar (Director)
N.K. Dadhich
S.V. Dhurandhar
A.K. Kembhavi
R. Gupta
V. Sahni (from February 25)
S.N. Tandon (on sabbatical leave from TIFR, Bombay)

Scientific Staff

P.A. Malegaonkar
V. Chellathurai
S. Shankar
A. Paranjpye (on leave from IIA, Bangalore, from 3.8.90 to 31.1.91)
N.V. Agashe
M. Aroskar
P. Chordia
V. Mistry

Administrative and Supporting Staff

T. Sahay
R.Y. Deshpande
K.M. Abhyankar
N.V. Abhyankar
P. Krishnan
R.D. Pardeshi
B.V. Sawant
S.N. Khadilkar
M.A. Mahabal
M.S. Sahasrabudhe
R. Rao
S. Samuel
N. Pargaonkar
B.B. Jagade
M.A. Raskar
V.S. Satpute
B.R. Gorkha
V.R. Surve
S.R. Tarphe
A.W. Gangawane
K.M. Babu

Visiting Members of IUCAA

Visiting Professors

Abhay Ashtekar
Syracuse University, USA

C.V. Vishveshwara
Raman Research Institute, Bangalore

Senior Associates

S.M. Alladin
Centre for Advanced Study in Astronomy,
Osmania University, Hyderabad

S.M.R. Ansari
Department of Physics,
Aligarh Muslim University, Aligarh

S. Banerji
Department of Physics,
University of Burdwan, Burdwan

K.B. Bhatnagar
Zakir Husain College, New Delhi

H.L. Duorah
Department of Physics,
Gauhati University, Gauhati

A.N. Maheshwari
Cochin University of Science and Technology,
Kochi

S. Mukherjee
Department of Physics,
North Bengal University, Siliguri

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Department of Physics,
University of Delhi

L.K. Patel
Department of Mathematics,
Gujarat University, Ahmedabad

V.R. Venugopal
School of Physics,
Madurai Kamaraj University, Madurai

S.D. Verma
Department of Physics and Space Science,
Gujarat University, Ahmedabad

Associates

G.M. Ballabh,
Department of Astronomy,
Osmania University, Hyderabad

Suresh Chandra
Department of Physics,
University of Gorakhpur, Gorakhpur

B.N. Dwivedi
Department of Physics,
Banaras Hindu University, Varanasi

K.N. Iyer
Department of Physics,
Saurashtra University, Rajkot

Pushpa Khare
Department of Physics,
Utkal University, Bhubaneswar

S. Mahajan
Department of Physics,
St. Stephens College, Delhi

S.K. Pandey
Department of Physics,
Ravishankar University, Raipur

L.M. Saha
Department of Physics,
Zakir Husain College, Delhi

R.S. Tikekar
Department of Mathematics,
Sardar Patel University, Vallabh Vidyanagar

Post-Doctoral Fellows

P. Das Gupta
A.K. Kshirsagar
B.S. Sathyaprakash
S. Wagh (C-DAC Project)

Research Scholars

Debiprosad Duari
Tarun Ghosh
Kanti Jotania
Sucheta Koshti
Roopesh Ojha

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Department of Physics,
University of Burdwan, Burdwan

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Zakir Husain College, New Delhi

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Gauhati University, Gauhati

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Madurai Kamaraj University, Madurai

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Department of Physics and Space Science,
Gujarat University, Ahmedabad

Associates

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Department of Astronomy,
Osmania University, Hyderabad

Suresh Chandra
Department of Physics,
University of Gorakhpur, Gorakhpur

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Department of Physics,
Banaras Hindu University, Varanasi

K.N. Iyer
Department of Physics,
Saurashtra University, Rajkot

Pushpa Khare
Department of Physics,
Utkal University, Bhubaneswar

S. Mahajan
Department of Physics,
St. Stephens College, Delhi

S.K. Pandey
Department of Physics,
Ravishankar University, Raipur

L.M. Saha
Department of Physics,
Zakir Husain College, Delhi

R.S. Tikekar
Department of Mathematics,
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S. Wagh (C-DAC Project)

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Tarun Ghosh
Kanti Jotania
Sucheta Koshti
Roopesh Ojha

IUCAA Fellow on the GMRT Project

Sulekha Deshwandikar

Visitors

K.B. Bhatnagar (April 6-11),
Zakir Husain College, Delhi.

S.D. Verma (April 8-9),
Gujarat University, Ahmedabad.

S. Banerji (April 8-11), University of Burdwan.

K.D. Abhyankar (April 9-11),
Osmania University, Hyderabad.

V.R. Venugopal (April 9-11),
Madurai Kamaraj University.

C. Debi Prasad (April 9-11),
Physical Research Laboratory, Ahmedabad.

H.S. Gurm (April 10-11), Punjabi University, Patiala.

Marc van der Valk (May 9-24),
Universitas Rhenotraiectina, Holland.

R.S. Tikekar (May 17-June 8),
Sardar Patel University, Vallabh Vidyanagar.

L.K. Patel (May 18-June 8),
Gujarat University, Ahmedabad.

P. Shastri (May 22),
Indian Institute of Science, Bangalore.

D.K. Chakraborty (May 28-June 14),
Ravishankar University, Raipur.

S.K. Pandey (May 28-June 21),
Ravishankar University, Raipur.

S.D. Verma (May 29),
Gujarat University, Ahmedabad.

Pushpa Khare (May 29-June 22),
Utkal University, Bhubaneswar.

R. Nityananda (June 3-10),
Raman Research Institute, Bangalore.

T.P. Prabhu (June 3-13),
Indian Institute of Astrophysics, Bangalore.

P.C. Agarwal (June 7-9),
Tata Institute of Fundamental Research, Bombay.

K.R. Anantharamaya (June 11-16),
Raman Research Institute, Bangalore.

Alak Ray (June 17-19),
Tata Institute of Fundamental Research, Bombay.

B.V. Sreekantan (June 20-21),
Tata Institute of Fundamental Research, Bombay.

A. Sathaye (June 22), Kentucky University, Lexington.

N.C. Mathur (June 25-29),
Indian Institute of Technology, Kanpur.

H.L. Duorah (July 27-August 4),
Gauhati University, Gauhati.

J.N. Desai (July 29-August 2),
Physical Research Laboratory, Ahmedabad.

S. Raychaudhuri (July 30-August 2),
Institute of Astronomy, Cambridge.

Nikhilesh Pal (July 30-August 5),
Indian Astronomical Society, Calcutta.

S. Bharadwaj (July 30-August 9),
Indian Institute of Science, Bangalore.

S.D. Verma (July 31-August 5), Gujarat University, Ahmedabad.

C.K. Shah (July 31-August 5),
Gujarat University, Ahmedabad.

N.C. Rana (July 31-August 4),
Tata Institute of Fundamental Research, Bombay.

N.C. Wickramasinghe (August 1-4),
University of Wales, Cardiff.

G.L. Kalra (August 1-6), University of Delhi.

T. Vachaspati (August 1-9), University of Cambridge.

L.M. Saha (August 2-9), Zakir Husain College, Delhi.

S.K. Pandey (August 14-29),
Ravishankar University, Raipur.

Harry C.S. Lam (August 17),
McGill University, Montreal, Canada.

M.G.K. Menon (August 18), Minister of State for Science and Technology, Government of India.

P.K. Gupta (August 18-23),
Centre for Advanced Technology, Indore.

I. Mukherjee (August 28-29),
National Council of Science Museums, Calcutta.

G.S. Lakhina (August 30-31),
Indian Institute of Geomagnetism, Bombay.

Pushpa Khare (August 31-September 15),
Utkal University, Bhubaneswar.

D.K. Ojha (August 31-September 24),
Uttar Pradesh Solar Observatory, Nainital.

S.K. Datta (September 2-18), Institute of Radio Physics and Electronics, University of Calcutta.

M.K. Sharan (September 13-16),
Tata Institute of Fundamental Research, Bombay.

K.D. Purohit (September 14-18),
H.N.B. Garhwal University, Srinagar.

S. Mukherjee (September 18-October 18),
North Bengal University, Siliguri.

T.P. Prabhu (September 25-28),
Indian Institute of Astrophysics, Bangalore.

L.P. Singh (October 2-3),
Utkal University, Bhubaneswar.

K.D. Abhyankar (October 2-4),
Osmania University, Hyderabad.

B.V. Sreekantan (October 3),
Tata Institute of Fundamental Research, Bombay.

R.S. Tikekar (October 14-November 14),
Sardar Patel University, Vallabh Vidyanagar.

L.K. Patel (October 23-November 11),
Gujarat University, Ahmedabad

Giovanni G. Fazio (October 27), Harvard Smithsonian Centre for Astrophysics, Cambridge.

Man Mohan (October 28-31),
University of Delhi, Delhi.

N.C. Rana (October 30-November 10),
Tata Institute of Fundamental Research, Bombay.

S.M. Chitre (November 30-December 3),
Tata Institute of Fundamental Research, Bombay.

Shyam Varan (December 9-January 1),
Indian Institute of Technology, Kanpur.

A. Misra (December 9-January 6),
Indian Institute of Technology, Kanpur.

R. Ramachandran (December 10-11),
Institute of Mathematical Sciences, Madras.

K.N. Iyer (December 10-25), Saurashtra University

M.D. Munshi (December 11-January 2),
Indian Institute of Technology, Kharagpur.

A. Chokshi (December 12-15),
Princeton University, USA.

Suresh Chandra (December 24-January 13),
Gorakhpur University, Gorakhpur.

Lalan Prasad (December 24-January 13),
Gorakhpur University, Gorakhpur.

I.W. Roxburgh (December 27-January 1),
Queens' Mary College, London.

Pushpa Khare (December 30-January 15),
Utkal University, Bhubaneswar.

Sai K. Iyer (December 31-January 12),
Physical Research Laboratory, Ahmedabad.

E. Wolf (January 1-4),
University of Rochester, New York.

P.N. Bhat (January 4-5),
Tata Institute of Fundamental Research, Bombay.

K. Shivanandan (January 7-8),
Naval Research Laboratory, USA.

R. Tikekar (January 8-14),
Sardar Patel University, Vallabh Vidyanagar.

C.N.R. Rao (January 9),
Indian Institute of Science, Bangalore.

S.R. Prabhakaran Nayar (January 9-16),
University of Kerala, Trivandrum.

B.K. Pal (January 31-February 9),
Himachal Pradesh University, Shimla.

S.K. Pandey (January 11-14),
Ravishankar University, Raipur.

S. Banerji (January 12-14), University of Burdwan.

R. Nityananda (January 12-14),
Raman Research Institute, Bangalore.

B.V. Sreekantan (January 13),
Tata Institute of Fundamental Research, Bombay.

P.V. Kulkarni (January 13),
Physical Research Laboratory, Ahmedabad.

A. Sen (January 15-18),
Institute of Plasma Research, Ahmedabad.

U.S. Pandey (January 18-22),
University of Gorakhpur.

S. Aarseth (January 20-25),
Institute of Astronomy, University of Cambridge.

Ram Sagar (February 3-4),
Indian Institute of Astrophysics, Bangalore.

S.K. Datta (February 4-6), Institute of Radio Physics and Electronics, University of Calcutta.

J.N. Desai (February 10-11),
Physical Research Laboratory, Ahmedabad.

N. Panchapakesan (February 10-11),
University of Delhi.

Alak Ray (February 11),
Tata Institute of Fundamental Research, Bombay.

Kameswara Rao (February 11-12),
Indian Institute of Astrophysics, Bangalore.

S.P. Gupta (February 15-17),
Physical Research Laboratory, Ahmedabad.

B.N. Karkera (February 17-19), Central Scientific Instruments Organisation, Chandigarh.

Vijay Mohan (February 17-19),
Uttar Pradesh Solar Observatory, Nainital.

J.N. Desai (February 17-20),
Physical Research Laboratory, Ahmedabad.

A.K. Saxena (February 17-21),
Indian Institute of Astrophysics, Bangalore.

J.K. Sharma (February 17-22),
Department of Science and Technology, New Delhi.

B.V. Sreekantan (February 21-22),
Tata Institute of Fundamental Research, Bombay.

P.V. Kulkarni (February 21-22),
Physical Research Laboratory, Ahmedabad.

S. Banerji (February 21-23), University of Burdwan.

P.J. Lavakare (February 21-23),
Department of Science and Technology, New Delhi.

J.C. Bhattacharya (February 21-23),
Indian Institute of Astrophysics, Bangalore.

K.D. Abhyankar (February 22-23),
Osmania University, Hyderabad.

Charles Correa (March 4), Architect, Bombay.

D. Mehta (March 4-5),
Indian Institute of Geomagnetism, Bombay

S. Ray (March 4-8), University of Burdwan.

S.P. Pandya (March 11),
Physical Research Laboratory, Ahmedabad.

S.K. Jain (March 12-15),
Indian Institute of Astrophysics, Bangalore.

R.S. Bisht (March 15-18),
Tata Institute of Fundamental Research, Bombay.

Anil Garg (March 16-17),
National Centre for Software Technology, Bombay.

Geeta Oommen (March 16-17),
National Centre for Software Technology, Bombay.

Director's Report

As IUCAA completes its third year its activities have grown on all fronts as described elsewhere in this annual report. During this year we moved yet again to another temporary abode. As the Akashganga Complex containing IUCAA's housing colony neared completion we moved our academic and administrative offices as well as the Library to four houses in the campus while Aditi — the shed we first built — is now being equipped for IUCAA's Instrumentation Laboratory. The computers also continue to be housed there.

Let me take this opportunity to express our grateful thanks to Govind Swarup and his colleagues at the National Centre for Radio Astrophysics for making available to us six office rooms as well as library space last year — when we needed the accommodation most. They extended this hospitality in spite of feeling the pinch for space themselves.

Now the work on the second phase — the institutional buildings is underway and all being well we should have moved our offices there by the time the next annual report is in your hands. We also hope to begin this year the construction of the 500-seater auditorium as part of the third phase of the construction programme.

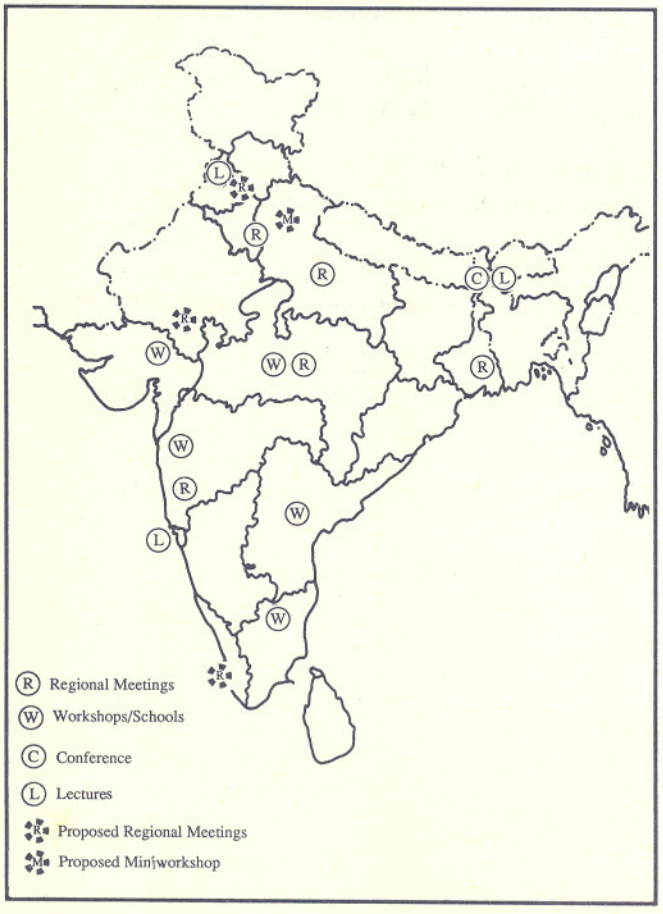


Figure 1: We have plotted points on the map of India where our academic activities have taken place so far. These include workshops, schools, regional meetings, etc. The map also shows places where activities are planned in the coming year.

Lack of proper accommodation has not hampered IUCAA from carrying out its objectives. A few figures illustrate how they are growing.

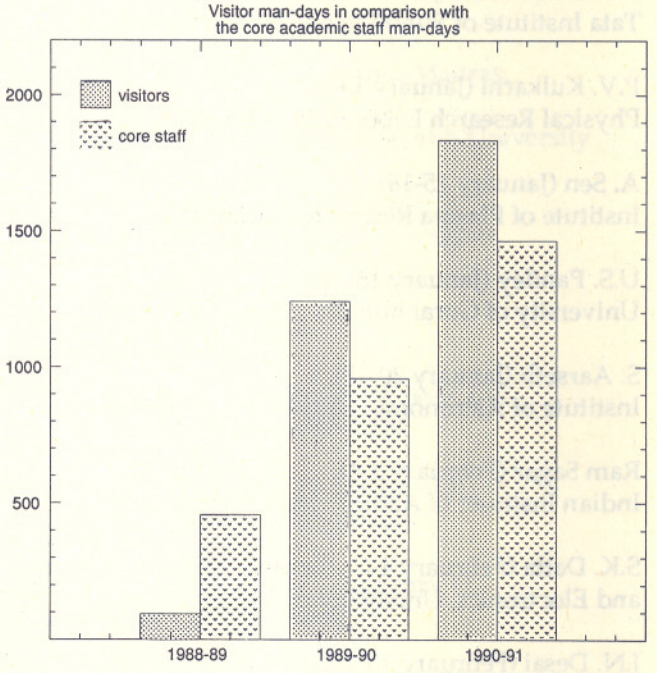


Figure 2: The histogram shows the number of visitor days at IUCAA over the last three years. For each visitor we count visitor days as the number of days he spends here. For a camparison we have also given the core staff days side by side.

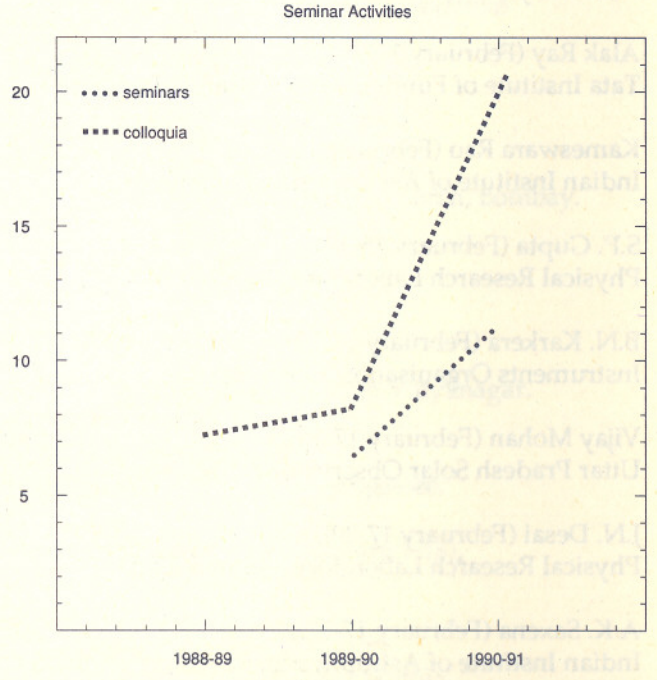


Figure 3: The graph shows the growth of seminar activity (lectures, colloquia, etc.) at our campus.

We look forward to a greater expansion in these activities next year as we move into the institutional buildings. Our aim is to attain a ratio 3:1 for visitors to core staff.

It was a pleasure to welcome the Governing Body for its fifth meeting at the IUCAA Campus. The meeting took place in the Director's Residence at 1, Akashganga on the Foundation Day, 29 December 1990. We were specially honoured by the visit of P.N. Haksar who delivered the Second Foundation Day Lecture on 'India and the World : Some Reflections'. The evening saw a cultural programme organized by the enthusiastic staff members.

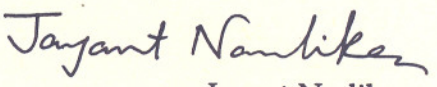
Because of the Gulf War the second meeting of the Scientific Advisory Committee had to be postponed along with a few other schools and workshops which came under the Government of India ban on holding scientific meetings as part of the austerity measure. These meetings are being rescheduled.

Khagol, the IUCAA Bulletin is coming out regularly every quarter and we are getting favourable comments. We would greatly appreciate any critical feedbacks from readers that might result in improvements.

Just as IUCAA was evolved through Poona University as the foster mother, so has it now served the same role for INFLIBNET ... a far reaching new scheme of the UGC of an inter-library network using satellite communication technology.

We are sad at bidding farewell to Yash Pal our first Chairman and President but hope that he will visit us as a scientist one of these days. We look forward to help and guidance from his successor Manmohan Singh in the years to come.

I am grateful to S.K. Khanna and A.K. Mathur and the ministerial staff of the UGC for helping out whenever needed, in many different ways. This aspect and the cooperation of my colleagues at IUCAA have made the task of running the centre a smooth one.



Jayant Narlikar

The Calendar of Events

April 10	Model M.Sc. A & A Syllabus Discussion Meeting
April 20-22	Regional Discussion Meeting for Uttar Pradesh Universities at Indian Institute of Technology, Kanpur
May 26	Regional Discussion Meeting for Eastern Region at Institute of Radio Physics and Electronics, Calcutta University, Calcutta
June 4-29	IUCAA-TIFR Introductory Summer School on Astronomy and Astrophysics, Pune
June 19	Governing Body Meeting at UGC, Delhi
June 19	Council Meeting at UGC, Delhi
July 1	The First Batch of Associates and Senior Associates joins IUCAA.
July 7-8	Selection of Research Scholars
August 1	First Semester of IUCAA Graduate School begins
August 1-4	Minischool on Interstellar Matter, IUCAA
August 1, 6-8	Minischool on Cosmic Strings, IUCAA
August 24	Launch of Phase II (Institutional) of IUCAA Campus
September 15-16	Regional Discussion Meeting for South Central Universities, Shivaji University, Kolhapur
November 8	Installation of CCD Camera
November 29	Signing of IUCAA's First Memorandum of Understanding with a University: with University of Poona
December 15	First Semester of IUCAA Graduate School ends
December 26	Shifting of Director's office and Academic Block from NCRA to Akashganga, IUCAA
December 29	Second Foundation Day Lecture and Celebrations
January 1-5	Minischool on Infrared Astrophysics, Madurai Kamaraj University, Madurai
January 3	First Seminar at 11, Akashganga
January 12-13	First Amateur Astronomers' Meet, Pune (sponsored by IUCAA)
January 15	Second Semester of IUCAA Graduate School begins
January 16-21	Miniworkshop on N-Body Simulations in Stellar Dynamics, Centre for Advanced Study in Astronomy, Osmania University, Hyderabad
Januray 20-25	Miniworkshop on Relativistic Astrophysics, PRL, Ahmedabad
January 23	Shifting of Library from NCRA to Akashganga, IUCAA
January 25	Shifting of Administrative offices from Aditi to Akashganga, IUCAA
February 22	Meeting of the UGC Committee on Astronomy Facilities in Universities, IUCAA
February 28	Celebration of National Science Day by organizing a Science Quiz for school students of Pune
March 31	Second Semester of IUCAA Graduate School ends

Seminars

C. Debi Prasad: 'Astronomical application of Fabry-Perot Spectroscopy', April 11.

K.B. Bhatnagar: 'Chaos in Astronomy', April 11.

Marc van der Valk: 'Cells and quasars', May 21.

Prajval Shastri: 'Anisotropies in the emission of radiation from quasars', May 22.

A. Sathaye: 'Old and new problems in algebraic curves', June 22.

N.C. Mathur: 'Radio astronomy at millimetre wave', June 27.

S. Raychaudhuri: 'The great attractor and beyond', July 31.

S.R. Gadre: 'Bounds and parallelisation in electronic structure calculation', August 22.

L.K. Patel: 'Some new radiating Kerr-Newman solutions', November 9.

R. Tikekar: 'Non-adiabatic collapse of a radiating star', November 9.

Arati Chokshi: 'QSOs and the X-ray background : cause and effect', December 13.

K.N. Iyer: 'Recent trends in atmospheric research', December 21.

Emil Wolf: 'Recent research in optical coherence', January 3.

K. Shivanandan: 'Multi-wavelength observations of IRAS sources', January 7.

Sai Iyer: 'Centrifugal force reversal', January 11.

Abhijit Sen: 'Magnetic confinement fusion using Tokamaks - Prospects and issues', January 16.

Sverre Aarseth: 'N-body methods', January 21.

Sverre Aarseth: 'N-body simulations of planetary formation', January 24.

S.K. Jain: 'A rocket borne payload for high resolution extreme UV study of Sun', March 13.

Anil Garg: 'Academic Networking', March 16.

Varun Sahni: 'Gravity waves from inflation', March 21.

Colloquia

Yash Pal: 'Ways of seeing and relating', May 14.

C.S. Harry Lam: 'Superstring theory as theory of space-time?', August 17.

R.A. Mashelkar: 'Fascination of non-Newtonian fluids', September 10.

J.V. Narlikar: 'A critique of the Big Bang cosmology', October 1.

S.M. Chitre: 'How well do we know our Sun?', December 3.

R. Ramachandran: 'Spin statistics and their connection', December 10.

I.W. Roxburgh: 'Space experiments on Gravity', December 30.

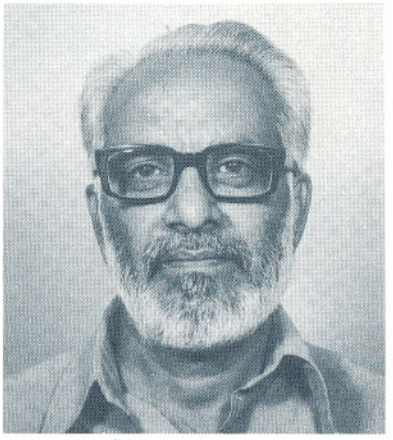
Emil Wolf: 'Correlation-induced frequency shifts of spectral lines', January 2.

C.N.R. Rao: 'Some new insights into high temperature oxide superconductors', January 9.

Charles Correa: 'Transfers and Transformations', March 4.

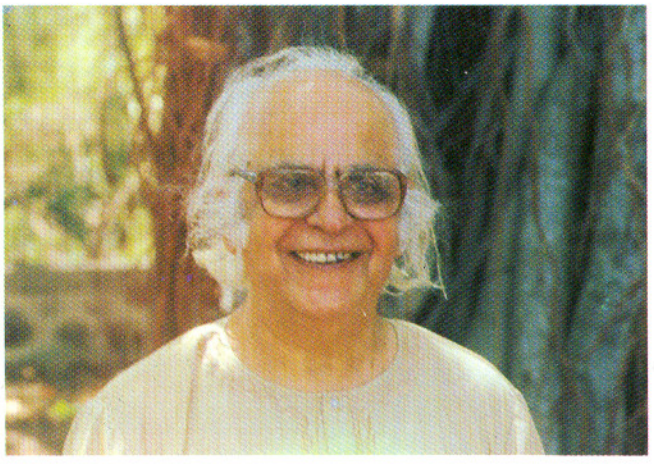
S.P. Pandya: 'Radioactivity — Old is beautiful', March 11.

D.S. Kothari



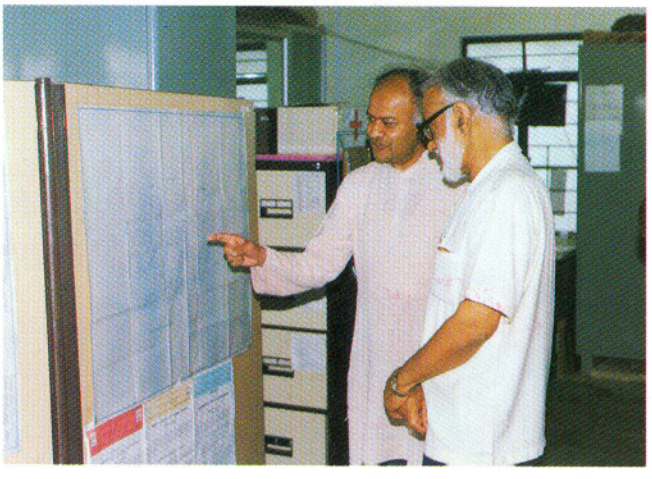
N.V.G. Sarma

C.V. Vishveshwara



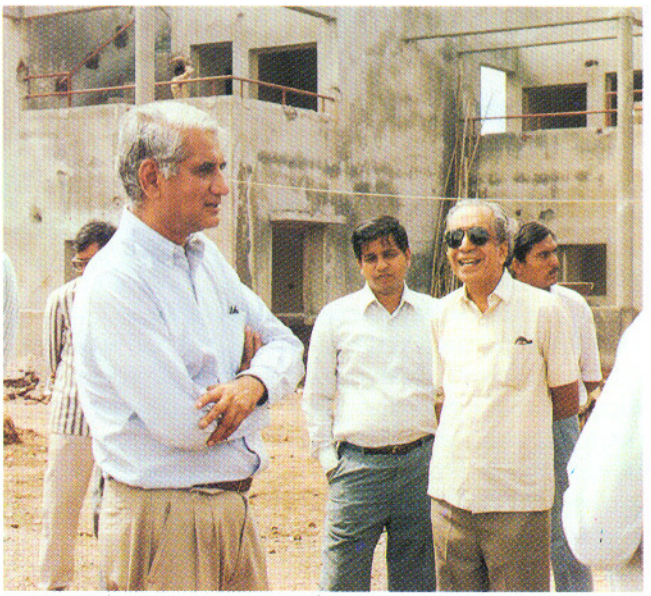
Yash Pal

P.N. Haksar: Foundation Day Lecture



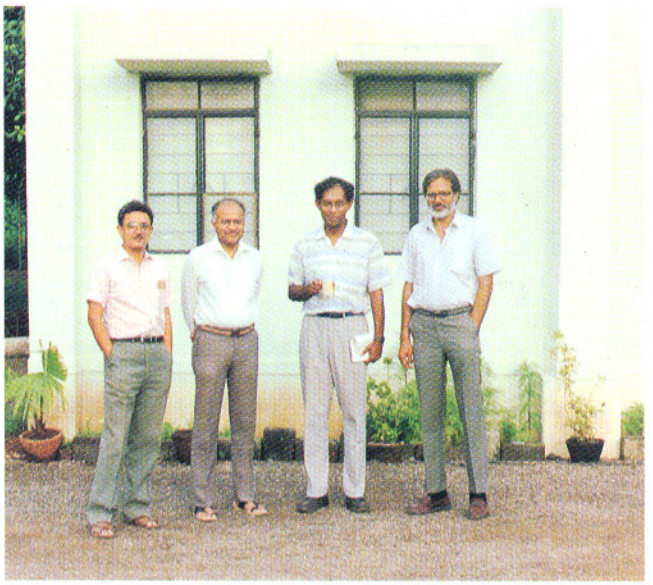
M.G.K. Menon

E. Wolf



Charles Correa

Signing of MOU with Poona University



N.C. Wickramasinghe

Amateur Astronomers' Meet

Mini-school on Infrared Astrophysics: Madurai Kamaraj University

Academic Activities

(I) Research

General Relativity without metric

In the past year, Dadhich, Koshti and Kshirsagar, (DKK) have concentrated their efforts on the 'pure-connection formulation of general relativity', a recent development. This formulation is precisely that of general relativity but without the presence of metric and offers itself as a natural covariantisation of Ashtekar's formulation of GR in terms of his new variables. The basic idea is to express the field content of general relativity in terms of a metric compatible connection where the metric itself is derived from the curvature due to this connection. The action for GR is then expressible in terms of this curvature, a set of self-dual two forms and auxiliary fields. It can easily be extended to include cosmological constant, fermionic matter, guage fields and supergravity.

This action enjoys gauge and diffeomorphism invariances, which lead to a set of constraints. DKK have explicitly calculated the constraints by evaluating the energy-momentum tensor from first principles and shown that they are indeed the correct version of Ashtekar's constraints, in the case of non-vanishing cosmological constant. This also leads to a natural interpretation of the auxiliary field in the action. DKK further show that the original action due to Capovilla, Jacobson and Dell is unique only upto terms ensuring the tracelessness of the auxiliary field matrix. This fact is useful in reconciling various alternate actions in the literature. Presently, work is in progress in analyzing the constraints in the case of matter and Yang-Mills couplings, as well as in attempting to include scalar matter in the action. Realization of conformal transformations in this description of GR is also being looked at.

Wormholes are interesting topological fluctuations arising in the Euclidean path integral formulation of gravity. Their implications are far reaching, all the way upto the possible explanation of vanishing of the cosmological constant. Work is in progress to obtain wormhole solutions in higher order theories of gravity coupled to a scalar field, in collaboration with S. Mukherjee and B.C. Paul from North Bengal University.

Collaborative work is also ongoing with Ramesh Tikekar and L.K. Patel on understanding the physical significnce of the solutions of Einstein's equations with radiation.

Gravitational Waves

Coalescing binaries are one of the more promising candidates for detection with the new generation of laser interferometric gravitational wave detectors because of their broadband nature. Since the expected signal is weak it will be buried into the noise. Matched filtering techniques can be applied to extract this signal since the waveform can be well modelled. This necessitates the computation of the Fourier Transform and this is done in two ways. An analytic but approximate expression is obtained by the stationary phase method and the result is compared with the Fourier Transform obtained numerically. A detailed study of padding the waveform with zeros is made. Padding improves the results. Results of 50%, 75% and 87.5% padding are compared. It is found that the time of coalescence plays a preferred role. This work was done by S.V. Dhurandhar, Patrick Das Gupta, and B.S. Sathyaprakash.

Although the waveform can be calculated for a known set of parameters namely, the mass parameter, phase and the time of arrival, the parameters of the signal are not known priori. Several filters have to be constructed corresponding to a lattice in the parameter space. The phase information is obtained by a trick (Dhurandhar and Schutz [private communication]) of splitting the signal on a 2 dimensional basis of functions. In the mass parameter space, however a lattice spacing of filters is necessary. The method for the construction of the filters which can detect a minimum strength signal is given. Numerical results are included and timings are given for results obtained by parallel processing on transputers. These investigations were carried out by B.S. Sathyaprakash and S.V. Dhurandhar.

Further work is going on to include noise due to standard recycling. Optimal Wiener filters are being constructed. Also as the coalescence approaches post Newtonian effects become important. Work is in progress to include these effects in the waveform and the signal-to-noise ratios. Some interesting results have been obtained. Sanjay Wagh is working on these issues.

The cross correlation for a slight mismatch of parameters between the signal and the filter is obtained analytically. The indeterminacy in the time of arrival of the signal is estimated by computing the covariance metrix, which furnishes a lower bound on the variance of parameters (Cramer-Rao inequality). S.V. Dhurandhar, A. Krolak and B.F. Schutz are working on this problem.

Investigations are also being carried out of data analysis of pulsar signals. The signal has to be analysed over long periods typically of the order of a few months. The technology of long FFTs is needed. Also the signal which is at a single frequency gets frequency and

amplitude modulated due to the motion of the earth and the quadrupole antenna pattern of the detector. Work is in progress. K. Jotania and S.V. Dhurandhar are carrying out the analysis.

Another problem of great immediate interest is the optimal orientation problem for a network of detectors. Investigations have just begun. The result will be of great importance in planning the orientations of the detectors around the globe. S.V. Dhurandhar and his coworkers are looking into this issue.

Quasar Redshifts: An Evidence for Periodicity?

Over the years there have been several publications for and against the claim that redshift distribution for quasars shows periodicity. What are quasars? What are redshifts? What is meant by periodicity?

Quasars are strong concentrated sources of energy in space. According to conventional interpretation a typical quasar may outshine an entire galaxy of a hundred billion stars and yet all its energy may come from a region no larger than the Solar System. The spectrum of light of a quasar shows a few bright lines familiar to spectroscopists. However, the lines invariably appear with wavelengths longer than laboratory spectroscopy would expect. This shift of the lines towards the longer wavelength (red colour) end of the 7-colour spectrum is called 'redshift' and it is believed to arise from the expansion of the universe. Conventional wisdom has it that the larger the redshift the farther away the source of light must be.

By now about 5000 quasars are known and we would expect their redshifts to be distributed in a smooth manner. Instead they seem unevenly distributed with peaks and troughs. The question is, do these peaks occur with a systematic period - as the crests of a wave? Or are the spiky ups and downs not significant enough to worry about? This is where controversy exists.

Recent work by Debiprosad Duari, Patrick Das Gupta and J.V. Narlikar points to evidence in favour of a real effect. Four independent statistical tests applied to the data reveal an underlying periodicity of about 0.06 in the redshift. Interestingly a periodicity of about the same magnitude was first reported by Geoffrey Burbidge more than two decades ago — when the quasar numbers was thirty times smaller. If the effect is real it would require considerable ingenuity to find an explanation, and therein lies the main problem for theorists.

The X-ray spectra of quasars

In spite of the voluminous X-ray data now available on quasars, little is known about their X-ray spectra, especially in the region below 1 keV. Active galactic nuclei have a universal power-law in the region of N1-10 keV, and there are indications that quasars may have such a spectrum too, though with greater dispersion in the power-law index. However the situation is more complex below a few keV, where a variety of power-law slopes is seen. The shape of the spectrum around 0.1 keV is not known observationally, but has important bearing on the number of quasars seen by detectors aboard ROSAT, which has just completed an all sky X-ray survey. Ajit Kembhavi, in collaboration with Andy Fabian, has been investigating various spectral models in the low energy region to make predictions about ROSAT results. Ajit Kembhavi has also investigated in detail the effects of relativistic beaming on the X-ray spectra, and has shown that the relatively flat observed X-ray spectra of radio quasars arise due to the relativistic boosting of an intrinsically weak flat spectrum component.

Optical observations with the CCD

The study of the distribution of optical radiation in galaxies, i.e., galaxy surface photometry, provides information on the distribution of luminous matter, mass-to-light ratio, bulge-to-disk ratio, the effect of interaction between neighbouring galaxies on their structures etc. The use of CCD (Charge Coupled Device) cameras allows galaxy surface photometry to be done rapidly and effectively, due to the high quantum efficiency and high dynamic range of the CCD detectors. A number of astronomical data analysis packages like IRAF and VISTA are now available, and the high volumes of data generated can be relatively simply analyzed. IUCAA has a continuing programme of surface photometric observations of different types of galaxies under the direction of Ajit Kembhavi. The data is being obtained at the prime focus of the 2.3 m Vainu Bappu Telescope at Kavalur, which is ideally suited for such observations, as well as the 1 m telescope of the Uttar Pradesh State Observatory at Nainital. Data on field galaxies was obtained using CCD cameras and broad band B, V, R and I filters during October 1990 to March 1991. The broad band data, besides being used in the manner described above, can also be used to study the distribution of colours across the galaxy, providing information about the mass function of stars in the galaxy as a function of position, and related parameters. The broad band observations will be supplemented by observations using narrow band filters centered on prominent emission lines when pertinent. A set of narrow band filters has recently been acquired for this purpose. The analysis of the data is being done using a network of SUN computers at IUCAA.

The observations and analysis are parts of collaborative programmes involving Ranjan Gupta of IUCAA, Tushar Prabhu from Indian Institute of Astrophysics, Bangalore, P.N. Bhat and K.P. Singh from Tata Institute of Fundamental Research, Bombay, Vijay Mohan from Uttar Pradesh State Observatory, Nainital, and S.K. Pandey of Ravishankar University, Raipur.

(II) Schools and Workshops

Introductory Summer School

The Introductory Summer School on Astronomy and Astrophysics (A&A) was jointly organised by IUCAA and NCRA (TIFR, Pune) during June 4-29, held entirely on the campus of Spicer Memorial College, Pune. The academic programme of 50 lectures on topics such as Stellar Structure, Supernovae and Pulsars, Interstellar medium, Molecular Clouds, Gravitation Theory, Radio, Optical X-ray, Gamma-ray and Infrared Astronomies and Cosmology was aimed at introducing astronomy and astrophysics to B.Sc. (III year), M.Sc. (I year) and B.E./B.Tech. (III year) students. About 40 participants in groups of 2-3 did a project study on some specialized topic and there were presentations of project reports in the concluding week. The faculty of the host institutions along with guest lecturers Rajaram Nityananda, K.R. Anantharamaya, T. Prabhu, Vijay Mohan, P.C. Agarwal, Alak Ray and B.V. Sreekantan made the school successful.

Mini-School on the Theory of Cosmic Grains

During August 1-4 N.Chandra Wickramasinghe from the University of Wales, Cardiff, UK, delivered a set of four thought provoking lectures.

In his first two lectures, Chandra explained the nature of obscuration of starlight produced by the interstellar medium, which ought to contain dust particles of micron to sub-micron size. In order to find out the chemical composition of these interstellar dust grains, one has to study the optical properties of the grains, namely the absorption, scattering and polarisation. Chandra described the results of the Mie theory applied to spherical dust grains and his own later work on cylindrical grains.

Arguing from the general composition of the interstellar medium, Chandra stressed the limited interstellar resources of carbon, oxygen, silicon, magnesium and iron to form interstellar dust grains. The most probable constituents of the interstellar dust grains turn out to be ice, silicates, graphite and organic molecules.

Detailed study of the law of interstellar extinction shows a pronounced peak in the ultraviolet at about 2170 A. For a long time, this peak was believed to be due to small spherical graphite grains. But there are difficulties in understanding the need for spherical grains of a particular size.

In his last two lectures, Chandra focused on the problems of fitting the extinction curves in the far ultraviolet and of some specific absorption features in the infrared. He showed how desperate attempts at explaining the absorption/emission peaks in terms of the conventional models of the dust grains made up of ice-coated siliceous material could not be successful. Inclusion of biotic material in the composition of these grains such as the E. Coli bacterium, and aromatic molecules not only improves the fit to the observational data on the extinction profiles but also the flat wavelength dependence of the degree of polarisation in the infrared bands.

Chandra also addressed the question of how the biotic material could possibly grow in the interstellar environments, given the destroying agents such as the stellar ultraviolet radiation, energetic cosmic ray particles, etc. In spite of all odds, he reasoned for the possible cometary sites of nutrient resources, where bacteria can multiply at super-astronomical rates and spread across the galactic and even the extragalactic distances within one Hubble time. Regarding the spontaneous emergence of life on Earth by purely chemical processes, Chandra estimated an extremely low probability — one part in $10^{40,000}$. Thus, he argued, the universe as per the big bang cosmology is unable to account for the origin of life in the limited time scale.

Mini-School on Cosmic Strings

In the first week of August, Tanmay Vachaspati from Tufts University, delivered a set of four lectures on the theme of cosmic strings. He started his discussion with ideas like symmetry breaking and phase transitions in a field theory, using a real self-interacting scalar field theory. He showed that the formation of domain walls, and topological defects in general, is quite generic to self interacting field theories. He demonstrated that such effects are stable and persist in the context of finite temperature, thereby becoming quite relevant to the phase transition in the early universe.

He then moved on to the topic of strings as topological defects. They are formed in the context of a complex scalar field whose finite temperature Lagrangian exhibits a global U(1) gauge invariance and whose potential has the form of the bottom of a wine bottle or a Mexican hat. The solution to the equation of motion known to this date is in a non-closed form, with limiting cases

known analytically. Symmetry considerations dictate that the solution corresponds either to an infinite string or a closed loop. A computer simulation of the string network was also described. He further showed how bounds on some physical parameters of axions could be set by the lifetimes of red giant stars and the mean density of the universe.

Tanmay discussed various phenomena like intercommuting of strings, gravitational radiation from strings and the rocket effect, collapse of a string loop and formation of black holes etc. The gravitational effects due to the presence of a cosmic string in the universe are largely because of the conical spacetime structure in its vicinity. Lensing effect and formation of double images of a star is one such. The conical metric can also be used for candidate explanations of anisotropy in the microwave background and sheet like large scale structures in the universe.

In his last lecture, Tanmay discussed a few speculative ideas about the origin of primordial galactic magnetic fields, as seed fields for the operation of a galactic dynamo.

Mini-School on Infrared Astrophysics

The mini-school was conducted in the School of Physics, Madurai Kamaraj University, Madurai during January 1-5. The participants numbering 12, were drawn from various universities, colleges and research institutes. K. Shivanandan of the Naval Research Laboratory, USA was the main lecturer and V.R. Venugopal and S. Balasubramanian made the local arrangements.

The thrust of Shivanandan's lectures was to present to the participants (most of whom were uninitiated in the subject), an up to-date review of the field of infrared astrophysics and to take them on a quick grand tour of the infrared sky, highlighting in particular the results obtained so far from the infrared astronomy satellite (IRAS) observations. He accomplished this objective through an introductory lecture covering fundamental concepts of infrared astrophysics, 6 lectures on IRAS overview, infrared stars and interstellar medium, HII regions and giant molecular clouds, the galactic plane and galactic centre, extra galactic infrared astronomy and the infrared spectroscopy project of the Naval Research Laboratory. V.R. Venugopal, D.G. Banhatti, Gopal Kilambi, Sam. Ragland and J.J. Rawal briefly described their current research activities.

Mini-Workshop on N-body Simulations in Stellar Dynamics

A mini-workshop was held during January 16-21 in Hyderabad at the Centre for Advanced Study in Astronomy, Osmania University against the backdrop of the Gulf War.

The highlight of this workshop was a series of lectures by Sverre J. Aarseth from the Institute of Astronomy, University of Cambridge, UK, covering various aspects of computer simulations of many galactic bodies interacting according to Newtonian laws. The lectures were focussed on the huge FORTRAN code developed by him, over many years. Sverre discussed many subtleties associated with the numerical integrations, time-steps, different regularization methods developed to deal with coinciding coordinates and formation of binaries due to capturing orbits. His lectures were delivered in a pedagogical style and served as a self-contained introduction to N-body simulation.

The workshop also had lectures by K.B. Bhatnagar, R.B. Singh and Namboodiri on other aspects of the few-body calculations. On one of the evenings the participants were provided with a delightful slide-show of African wild-life made by Sverre.

Mini-workshop on Relativistic Astrophysics

A mini-workshop was held at PRL, Ahmedabad, during the week January 20-25. In order to get a working theme, the discussions were restricted to only five topics: Observational Features in High Energy Astrophysics — J.N. Desai, General Relativity and Accretion Dynamics — A.R. Prasanna, Plasma Magnetosphere — A.C. Das, Radiation Emission in Astrophysics — Vinod Krishan, and Neutron Stars: Structure and Dynamics — Bhaskar Datta. P. Bhaskaran and S.C. Tripathy each gave a seminar highlighting the methodology and results in the context of thin magnetofluid disks around compact objects.

The five day meeting thus brought to the forefront the importance of considering plasma physical concepts more thoroughly both for structure and dynamics of disks as well as in the emission features. Further, the main problems of interest that could be pursued were highlighted in the discussions concerning the general relativistic features associated with dynamical and secular instabilities for rotating, ultra compact objects; the boundary layer discussions of disk — magnetosphere structure and coherent emission mechanisms due to plasma processes arising from microinstabilities.

(III) The Foundation Day Lecture

Shri P.N. Haksar gave the 2nd Foundation Day Lecture on "India and the World - Some reflections", in the Amphitheatre of Fergusson College, the synopsis of which follows.

This century is distinguished from the rest of the history of mankind by two factors; one upsurge of human consciousness and two explosion of human knowledge. These factors almost determine a democratic and secular political structure. India did well in adopting right kind of political structure but there is stupendous task ahead of building up of a just social structure.

In the world frame, it is imperative that the countries of the third world come together with a genuine spirit of cooperation and sharing in business, trade, science, technology and development. The speaker hoped that the Indian intellegentia would rise to meet the challenges facing the country today.

(IV) Publications

a) Journals and Proceedings

Technical

N. Dadhich, S. Koshti and A. Kshirsagar (1991) On constraints of pure-connection formulation of general relativity for non-zero cosmological constant, Class. and Quant. Grav., 8, L61

R. Gupta (1990) First results of 630 mm nightglow measurements from Kolhapur (with G.K. Mukherjee and Peter Dyson), Proceedings of International Symposium on Optical and Radio Remote sensing of the atmospheric environment, 24-26 October, New Delhi

____ (1991) Instrumental broadening caused by the misalignment function in a Fabry-Perot etalon assembly (with C. Debi Prasad), Applied Optics, 30, 373

J.V. Narlikar (1990) Extragalactic universe : An alternative view, (with H.C. Arp, G. Burbidge, F. Hoyle and N.C. Wickramasinghe), Nature, 346, 807

____ (1990) Associations between quasi-stellar objects and galaxies (with G. Burbidge, A. Hewitt and P. Das Gupta) Ap. J. Suppl.74, 675

____ (1990) Quantum Conformal Cosmology Developments, General Relativity, Astrophysics and Quantum Theory CA Jubilee volumen in honour of Nathan Rosen, ed. Cooperstock, Institute of Physics, Bristol, 89

____ (1990) New observations of cosmic relic radiation, Physics Education, 7, 156

S.M. Wagh (1991) TeV Gamma ray production in accreting black hole systems (with P. Slane), Ap. J. Letters, 364, 198

Non-Technical

N. Dadhich (1990) General Relativity and Cosmology in India, in Physics and Astronomy Research in India, ed. N. Anantaraman (American Chapter of the Indian Physics Association), 160

____ (1990) Role of IUCAA in teaching of astronomy in India, Proceedings of Vth IAU Asia-Pacific Regional Meeting

A.K. Kembhavi (1990) Theoretical Astrophysics in India, in Physics and Astronomy Research in India, ed. N. Anantaraman (American Chapter of the Indian Physics Association), 157

____ (1990) Khagolshastriya Samshodhanachi Navi Suvidha — CCD Pratima (CCD — A New Detector for Astronomy), Sakal, November 15.

____ (1991) Sanganak Ani Khagolshastra (Computers in Astronomy) (with A.K. Kshirsagar) Sakal (Vidnyan Puravani), January 10

J.V. Narlikar (1990) IUCAA: A new experiment in the University Sector, Current Science, 59, 962-964

____ (1990) A sense of humour, Indian literature, 67

____ (1990) Cosmology and local environment, Lectures given at the Indian Institute of Advanced Study, Shimla, Manohar Publications, Delhi and IIAS, Shimla

____ (1990) Science Popularisation: a personal account, Indira Gandhi Award Lecture, INSA News, 3

____ (1990) Hindi mein vigyan ki padhai (The teaching of Science in Hindi), Rashtriya Asmita Aur Hindi, ed. Sushila Gupta, 17 (Dirgha Sahitya Samsthan, Delhi)

____ (1990) Patrapariwar : Gangadhar Mahambare yans patra (Letter to Gangadhar Mahambare), Sahitya Suchi, 24

____ (1990) Unhalyatalya suttitale anubhav (Recollections of summer vacations), Maharashtra Times, May 6

____ (1990) Vidnyanabaddalche audasinya ghatak (Indifference to science is dangerous), Sakal, September 13

____ (1990) Inter-University Centre for Astronomy and Astrophysics, in Physics and Astronomy Research in India, ed. N. Anantaraman (American Chapter of the Indian Physics Association), 74

____ (1990) Learning to live with science and technology, Foundation memorial lecture, Lala Shriram Institute for Industrial Research, in Indian Sc-Era of Stabilisation, ed. J.K. Nigam, Wiley Eastern, 259

____ (1991) What if the big bang didn't happen?, New Scientist, 129, 48

b) Books

J.V. Narlikar (1990) Taronki Jeevan Gatha (The Life Story of Stars), Read and Learn Series of NCERT, Delhi

____ (1990) Vaman Nahin Lauta (Vaman did not return), Rajpal and Sons, Delhi

____ (1990) From Black Clouds to Black Holes (Translated in Japanese by Tadaoki Yoneyama and Kenji Urata), Maruzen Co. Ltd., Tokyo

c) Book Review

J.V. Narlikar (1990) Gravitational Lenses, Proceedings of a conference held at the Massachusetts institute of Technology, June 20, 1988, ed. by J.M. Moran, J.N. Hewitt and K.Y. Lo (Springer-Verlag : Berlin), Ind. J. Phys. 64B, 413

____ (1991) Silhouettes: Anecdotes and profiles of science, by A.N. Kothare, in Times of India as 'Light Moments', February 10

d) Reports authored/edited

S.V. Dhurandhar
Proposal for Interferometric Gravity Wave Detector, Phase I: Developmental Work and Experiments.

J.V. Narlikar
Water transport in India, in Perspectives in Science and Technology, Technical Reports by the Science Advisory Council to the Prime Minister, Vol. 2, Department of Science and Technology, Har-Anand Publications/Vikas Publishing House.

(V) Pedagogical Activities

a) Teaching

(i) M.Sc. (Physics) Poona University

N.K. Dadhich
Electrodynamics 15 lectures
General Relativity 12 lectures

S.V. Dhurandhar
Mathematical Physics 15 lectures
Project supervision:
Radhika Srinivasan (M.Sc.), Responses of laser interferometric gravity wave detectors.
N. Pradeep (M.Sc.), Gravity waves from coalescing binaries.
Barve (T.Y. B.Sc.), Blackholes.

A.K. Kembhavi
Astrophysics 40 lectures
Project supervision:
Priya Barve (T.Y. B.Sc.), General Relativity

J.V. Narlikar
Cosmology 20 lectures
Electrodynamics 5 lectures

S.N. Tandon
Observational methods in Astronomy 8 lectures
Astronomy laboratory course

(ii) Introductory Summer School on A & A

N.K. Dadhich
Gravitation 3 lectures
Project supervision:
Black hole energetics
Particle orbits in the Schwarzschild spacetime
Path dependence of time

P. Das Gupta
Project supervision:
Hulse-Taylor Binary Pulsar

S.V. Dhurandhar
Gravitational waves 1 lecture

A.K. Kembhavi
AGN and Image Processing 3 lectures

A.K. Kshirsagar
Probing the structure of particle physics 1 lecture

Project supervision:
Statistical mechanics of stars

J.V. Narlikar
Cosmology — 5 lectures
Project supervision:
Nucleosynthesis

S.N. Tandon
Infrared Astronomy — 1 lecture

(iii) IUCAA Graduate School

S.V. Dhurandhar
Mathematical Physics — 1 Semester course

(iv) Refresher course in Physics
(Department of Physics, University of Poona)

N.K. Dadhich
Inverse Square law — 1 lecture

S.V. Dhurandhar
Special Relativity — 9 lectures

A.K. Kshirsagar
Special Relativity — 6 lectures
Hilbert Spaces and Operator theory — 8 lectures

J.V. Narlikar
Astrophysics as a branch of Physics — 1 lecture

(v) Astrophysics School at Goa University

N.K. Dadhich: Black Holes — 3 lectures

S.V. Dhurandhar: Gravitational waves — 2 lectures + tutorials

Ranjan Gupta: Astronomical instrumentation — 2 lectures

J.V. Narlikar: Cosmology — 3 lectures

B.S. Sathyaprakash: Gravitational wave: Data Analysis — 1 lecture + tutorials

b) Radio/T.V.

J.V. Narlikar

Radio
Avakashateel bhavishyavedh, Vidnyan Parichay Sadar, AIR, June 16.
Yetya Dashakache Bhavitavya, Vidnyan ani Tantradnyan Vikas, AIR, June 26.
Prithvi palikadil grahavar jeevsrushti ahe ka?, Vidnyan Parichay Sadar, AIR, August 13.
India of my dreams, AIR, January 28.

T.V.
Video lectures for undergraduate courses in Physics, EMRC, Pune, 'Special Relativity', October 29-November 2.
Vidnyanachi Garudjhep, Vidnyan ani Jeevan Sangharsha Shravya Dhvani Feet, Yashwantrao Chavan Maharashtra Open University at EMRC, Pune, November 21.
Rotation of earth, Indira Gandhi National Open University recording at EMRC, Pune, December 11-15.

(VI) Seminars and Invited Talks

a) Technical Talks

N.K. Dadhich
Rotating blackholes in magnetic fields, School of Physics, Australian National University, Canberra, July 23.
Extending the Bertrand's theorem to general relativity, Mathematics Department, Sardar Patel University, Vallabh Vidyanagar, November 26.
Inverse square law and Hooke's law in general relativity, Physics Department, Rajasthan University, Jaipur, February 21.

S.V. Dhurandhar
Aspects of gravitational wave data analysis: University of Barcelona, Spain, October 26.
Matched filtering the coalescing binary gravitational wave signal, University of Wales, Cardiff, November 5.
The Inverse problem in gravitational wave detection: Institute of Astronomy, Cambridge, December 5.
Gravitational waves and their detection, University of Poona, February 19.

Patrick Das Gupta
A review talk "Search for Astrophysical Gravitational Waves", XIVth Astronomical Society of India (ASI) meeting at PRL, Ahmedabad, January 29.

Ranjan Gupta

Working Party on Optical Interferometry — A report on the first Kodai Workshop held during August 10-17: Astronomy and Instrumentation Seminar, NCRA, TIFR, October 26.

Fabry-Perot Spectroscopy in Astronomy: Astronomy and Instrumentation Seminar, TIFR (NCRA), December 7.

Fabry Perot Spectroscopy in Astronomy: RRI, Bangalore, March 19.

A.K. Kembhavi

X-ray beaming in quasars, Institute of Astronomy, Cambridge, November 14.

X-ray beaming in quasars, NRAO, Jodrell Bank, November 21.

X-ray spectra of quasars, IIA, Bangalore, February 21.

Computers at IUCAA, Department of Computer Science, University of Poona, March 15.

A.K. Kshirsagar

'The role of Mathematics in Physics', 2 talks, Bhaskaracharya Pratisthan, Mathematics Research Foundation, Pune, February 14 and 21.

'Particle Physics and String Theory — Carry-on Strings', 3 talks, Department of Physics, University of Poona, March 6, 11, 12.

J.V. Narlikar

Some exciting and unsolved problems in astronomy, Guru Nanak Dev University, Amritsar, April 16.

Some unsolved and exciting problems in astronomy and astrophysics, S.K. Mitra Birth Centenary Memorial Lecture, Institute of Radiophysics and Electronics, Calcutta, May 25.

Some aspects of quantum cosmology, Department of Physics, National University of Singapore, Singapore, July 11.

Structures in the universe — open problems, at Galaxy Formation Workshop, TIFR, Bombay, September 3.

Is the universe expanding?, IIT Bombay, September 5.

Contribution of astronomy to our understanding of Physics, 21st reunion of Physics Department, Jadavpur University, November 3.

The origin of elements and cosmology, NCRA, TIFR Winter School, Pune, January 10.

B.S. Sathyaprakash

Detection of gravitational waves: Continuous and burst sources, Indian Institute of Science, Bangalore, April 13.

Filtering the Coalescing Binary Signal, Indian Institute of Science, Bangalore, April 16.

Generation and Detection of Coalescing Binary Signal, NCRA, TIFR, Pune August 11.

S.N. Tandon

Brown Dwarfs, NCRA, TIFR, Pune, February 9.

Telescopes for Astronomy — Possible Improvements in Future (Thirty Years of Scientific Ballooning in India, Hyderabad).

S.M. Wagh

Role of Computer in Biomechanical Analysis of Movement, Conference on Computer Applications in Physical Education and Sports, Amravati, March, 19.

b) Popular Talks

S.V. Dhurandhar

Black holes, New Arts, Commerce and Science College, Ahmednagar, February 22.

A.K. Kembhavi

CCDs in Astronomy: Amateur Astronomers' Meet, Pune, January 12.

A.K. Kshirsagar

Recent Developments in Particle Physics, Jyotirvidya Parisanstha, Pune, August 10.

J.V. Narlikar

Search for extra-terrestrial intelligence, Foundation course to officer trainees, Lal Bahadur Shastri National Academy of Administration, Mussorie, April 19.

Vishvat apan ekte ahot kay? (Are we alone in the universe?), Rohe lectures, Marathi Vidnyan Parishad, May 19-20.

Search for extra-terrestrial intelligence, Burdwan University, May 21.

The search for extra-terrestrial intelligence, Skywatchers Association, Burdwan, May 24.

Science popularisation: a personal account, Indira Gandhi Award Lecture, Indian National Science Academy Meeting, Centre for Advanced Technology, Indore, August 8.

Gurutvakarshan (Gravitation), at Mahatma Phule Museum for 9th Standard students, arranged by Niranjan Ghate.

Ekvisave shatak kase asel? (How will be the 21st Century?), Praadnya Pathshala Mandal, Wai, September 27.

Khagol-vidnyanatun ghadnare vishwache darshan (The universe as revealed by astronomy), Shantabai Limaye Memorial Lectures, Rachna Trust, Nashik, October 24-25.

Gurutvakarshanachi kimaya (Magic of Gravity), KTHM College, Nashik, October 25.

Scientific libraries from a user's point of view, Maharashtra Association for Cultivation of Science, Pune, November 12.

Are we alone in the universe?, Central School, November 16.
Highlights in modern astronomy, INS Shivaji, Lonavala, November 17.
Vidnyan drushti ani samajik parivartan, Seminar talk (Scientific vision and transformation), Tilak Smarak Mandir, Shankarrao Kirloskar birth centenary celebrations, December 30.
Vidnyan lokabhimukh kase karave, Lecture Series to commemorate the birth centenary of Late Shri G.R. Paranjape, Organised by Marathi Vidnyan Parishad, January 11.
Astrology and the common man, Amateur Astronomers' Meet, Pune, January 12.
Are we alone in the universe?, Goa University Extension Lecture Series, Margao, January 16.

B.S. Sathyaprakash
Gravitational Wave Detection, Jyotirvidya Parisanstha, Pune, May.

S.N. Tandon
Measuring distances in Astronomy, Jyotirvidya Parisanstha, Pune, February 17.

(VII) Collaborative Programmes and Conferences

a) Collaborative Programmes

Dadhich, Koshti and Kshirsagar have initiated collaborative work on a worm hole solution in general relativity with S. Mukherjee and B.C. Paul of North Bengal University and on the physical significance of solutions of the Einstein equations with radiation with L.K. Patel of Gujarat University and R.S. Tikekar of Sardar Patel University.

As a part of the collaboration with University of Wales, Cardiff, S.V. Dhurandhar visited Cardiff for a month and worked on the covariance metric of errors on the estimates of the parameters determining the coalescing binary signal. It was found that the problem can be elegantly formulated if we regard the covariance metric as a metric on the space of parameters.

Collaboration with C-DAC on gravitational wave data analysis by parallel processing on transputers which began in April 1990 is in progress. IUCAA has successfully used PARAM, the 64 transputer machine on which one gets a speed up of about 55 megaflops. S. Wagh, a post-doctoral fellow supported by C-DAC in this programme, is working on post-Newtonian corrections to the coalescing binary signal and the corresponding signal-to-noise ratios.

IUCAA proposes to have collaboration with CAT, Indore for the feasibility study of a gravity wave detector. A prototype 3-metre detector has been proposed and the proposal is being reviewed by various funding agencies.

The mechanism proposed in Slane & Wagh (1990) for production of TeV gamma rays is considered in the light of various accretion disk models. Wagh is presently collaborating with P. Slane, CFA, Cambridge, USA and T. Stanev, Batrol Research Foundation, Delaware, USA on the cascade production of TeV Gamma Rays in accretion disks.

Collaboration continues between G.R. Burbidge and A. Hewitt at the Centre for Astrophysics and Space Sciences, University of California at San Diego and J.V. Narlikar and P. Das Gupta at IUCAA on quasar statistics.

A. Kembhavi is collaborating with Andy Fabian of the Institute of Astronomy, Cambridge, on various aspects of quasar X-ray spectra.

b) Conferences

Nirupama Agashe
User oriented features of IUCAA Library Software 'SLIM', presentation during seminar on Networking of Libraries and Information Centres in Pune — Need and Solutions, Maharashtra Association for Cultivation of Science, Pune, November 12
IUCAA Library Software 'SLIM' presentation during workshop on Library and Information Services in Astronomy and Astrophysics, PRL, Ahmedabad, January 29-31

N.K. Dadhich
V IAU Asia-Pacific Regional Meeting, Sydney, Australia, July 16-20.
XIV Astronomical Society of India Meeting, PRL, Ahmedabad, January 29-February 1.

P. Das Gupta
GMRT Winter School, Pune, January.
XIV Astronomical Soceity of India Meeting, PRL, Ahmedabad, January 29-February 1.

S.V. Dhurandhar
Seminar on Lasers and its Applications, CAT, Indore, July 7.
Seminar on Curriculum Development in Mathematics, New Arts, Commerce & Science College, Ahmednagar, February 22-23.

Ranjan Gupta

The First Kodai Workshop of the Indian Academy of Sciences — A working party on Optical Interferometry, Kodaikanal Observatory, Kodaikanal, August 10-17.

Symposium on Modern Trends in Astronomy, PRL, Ahmedabad, November 1.

A.K. Kshirsagar

Participated in the IUCAA Mini-Workshop on 'N-body Simulations in Stellar Dynamics', Osmania University, Hyderabad, January 16-19.

J.V. Narlikar

Meeting on "Issues and problems relating to science and technology", Yojana Bhavan, New Delhi, June 28.

V IAU Asia-Pacific Regional Meeting, Sydney, Australia, July 16-20.

Workshop on Galaxy Formation, TIFR, Bombay, September 3.

S.M. Wagh

Conference on Computer Applications in Physical Education and Sports, Amravati, March 15.

(VIII) Awards and Distinctions

J.V. Narlikar

Sansthan Samman of Uttar Pradesh, Hindi Sansthan

Nagarkar Trust Award for Excellence

Facilities

Computer Centre

IUCAA has developed a network of workstations to serve its computing and image processing requirements. The network at the present consists of a SUN 4 server with 32 Mbytes core memory, disk space of about 2.5 Gigabytes and various peripherals, a SUN 386i workstation, 3 sparcstations and PC-compatibles using the NFS protocol. The network is expected to expand rapidly in the coming year, as the demand for computers is going up due to increase in the number of academics at IUCAA as well as visitors from the universities. In keeping with emerging trends the world over, it has been decided to base most of the computing at IUCAA on networked workstations. This permits a flexible approach which can be tailored to needs and resources, taking into account developments in computing technology which now occur over a timescale of several months.

IUCAA has a local area network of PC-compatibles of various kinds. This is employed to implement the library, accounts and administration software packages, as well as for word-processing, drafting and computer courses for students. The computer centre also provides facilities for typesetting, desk-top publishing and E-mail.

Library

The IUCAA Library is being developed as a major collection of the literature on astronomy, astrophysics and the related areas. In two years of operation is has acquired about 5000 books and catalogues, and hopes to increase its holdings very substantially in the next 2 years. The astronomical collection is supported by literature from the general areas of physics and mathematics. There is also a small number of books on the other basic sciences, arts and humanities. The library is being developed in such a manner that it benefits research workers as well as students and less experienced persons coming to IUCAA for summer schools, refresher courses and the like.

IUCAA now subscribes to 145 periodicals, most of which arrive by airmail. The idea is to have an up-to-date collection of scientific journals to which the university and the astronomical community does not usually have ready access.

A novel feature of the IUCAA Library is that all its functions are computerized. The software, developed "ab initio" by M/s Algorhythms in close consultation with IUCAA staff, resides on a network of IBM-PC compatibles. All user services like literature searches, issue of books, reservations etc. are computerized. The computerization also extends to all library management functions like acquisition of books and periodicals, accessioning and cataloguing, circulation monitoring etc. The software is user friendly and has been designed in such a way that it can be easily implemented in various university departments and institutions, on a single PC-AT or a network, at a reasonable cost.

The IUCAA library has recently shifted to a residence in "Akashganga", where all IUCAA offices are now located. The library anticipates a final shift to its permanent location next year.

Instrumentation Laboratory

The instrumentation laboratory is being established for developing instruments for astronomical observations and to provide such developmental facilities to the interested university groups and astronomers. With this aim we have been gradually acquiring electronic and optical test equipments. An air conditioned dark room with an optical bench on a granite top table is being set up. Following projects have been undertaken at the laboratory:

a) *Small Automated Telescopes*: The instrumentation laboratory is working on the development of small automated telescopes. The design is based on commercial sub assemblies e.g. optical tube assembly (a 35 cm Celestron — 14 tube), microstepping motors with drives, photosensors etc. The drives and the structure are designed for closed loop guidance with stellar images. Thus, the structure is made rigid enough so that the deflections are less than about 1', and friction-gear-drives with microstepping motors are used to obtain backlash free high resolution (3") movements. The acquisition mode is expected to have an accuracy of better than 3', and the closed loop controlled tracking will have an accuracy of 10". The tracking will be guided by signals from an imaging detector or an opto-electronic device designed to locate the stellar image in the field.

   The Telescope will be used under the control of a PC based system. At the moment it is planned that the use of these telescopes will be limited to photometric observations with light weight instruments such as solid state photometer/CCD camera etc.

b) *Detector System*: A position sensitive photo detector is being developed for use with the small telescopes. It is based on a commercial quadrant

hybrid solid state photo diode which measures the deviation of a stellar image (slightly defocussed) from the center of the field and also the flux density of the star under observation.

c) *CCD Camera*: Work has been started on the development of a CCD camera. The CCD will be housed inside a commercial liquid nitrogen dewar and its controller would incorporate microprocessor based hardware for compactness. This project is also aimed at the development of know how and laboratory resources such that interested university groups can use these facilities for the development of their own solid state cameras.

It is proposed to undertake a research training programme (under a DST scheme) for transferring the expertise developed in the above projects to interested university groups. This would lead to active groups of experimental astronomers.

The instrumentation laboratory setup will also be geared up for conducting post graduate practical courses, summer school projects, student's vacation projects etc.

Observing programmes and Image Processing

IUCAA has acquired a Celestron 14" and an Ultima 8" telescopes for star gazing, teaching and instrument testing. These have been used for atmospheric extinction measurements carried out by M.Sc. (Physics) students of the University of Poona with a SSP-3 Solid State Photometer as the back-end instrument. A thermoelectrically cooled CCD camera is used for imaging and illustrating principles of image processing.

Participation in National Projects

Feasibility Study of Large National Optical Telescope

As a follow up of the national meetings of astronomers held during August and October 1989 at IIA, Bangalore, DST has appointed a working group to study the feasibility of a Large National Optical Telescope. S.N. Tandon is participating in this study as the chairman of the working group. The group is concentrating on defining the best possible means of utilising the existing national resources and the important breakthroughs which have occured in the technology of large telescopes for developing a modern telescope with a much larger capacity than any of the existing optical telescopes in India.

Science Popularization Activity

Amateur Astronomers' Meet

The first Amateur Astronomers' Meet under the joint auspices of IUCAA and Jyotirvidya Parisanastha was held at Gokhale Institute of Politics and Economics, Pune during January 12-13. The main objective of the meet was to help develop manpower in A and A. Over 200 amateurs from all over the country attended the meet. J.V. Narlikar, in his welcome address, urged the amateur astronomers to educate the public on scientific explanations of phenomena in order to dispel superstitions. A. Bhatnagar, Jacqueline van Gorkom, A.K. Kembhavi, Prabhakaran Nayar, Rajamohan, J.J. Rawal, D.J. Saikia and B.V. Sreekantan spoke on different aspects of astronomy and astrophysics. About 15 papers were presented by the delegates on various aspects of amateurs' activities. An observation session, using the Celestron 14" and Ultima 8" telescopes was arranged at IUCAA, followed by screening of astronomical films. N.K. Dadhich concluded the meet with an appeal to banks and industries to give active encouragement to amateur astronomers. We are thankful to the Department of Science and Technology and Sakal Newspapers for providing the financial assistance for the meet.

Science Quiz

IUCAA organised a Science Quiz for school students of Pune to celebrate the National Science Day on February 28. The first prize was won by Abhinava Vidyalaya English Medium High School and the second prize was shared by the two teams of the Kendriya Vidyalaya, Southern Command. The student participation was not only enthusiastic but at a very commendable level. We plan to organize such a quiz on a larger scale on the next National Science Day.

Interaction with Universities

Regional discussion meetings

(1) A Regional Discussion Meeting for universities in Uttar Pradesh was held at IIT, Kanpur during April 20-22. Representatives from Aligarh Muslim University, Banaras Hindu University, H.N.B. University, the universities of Allahabad, Gorakhpur, Lucknow, Roorkee along with Uttar Pradesh State Observatory and faculty members of Physics, Electrical and Communication Engineering of the host institute exchanged views on

(i) teaching of special courses in A & A as parts of the M.Sc. Physics and Mathematics and Engineering disciplines,
(ii) introductory refresher courses for teachers,
(iii) library and documentation service in A and A,
(iv) collaborative inter-university research programmes,
(v) participation of IUCAA faculty as guest lecturers in the various universities and
(vi) participation of university students and teachers in GMRT project.

Popular lectures and seminars were arranged as a part of the meeting as follows:

J.V. Narlikar	—	Exciting problems in A and A
V.K. Kapahi	—	Radio view of the universe
N.K. Dadhich	—	Current research in gravitation
A.K. Kembhavi	—	High energy astrophysics
V.K. Kapahi	—	Radio astronomy

(2) A Regional Discussion Meeting was held at the Institute of Radiophysics and Electronics, Calcutta University on May 26. Representatives from the universities of Burdwan, Calcutta, Guwahati, Jadavpur, Manipur, North Bengal, Raipur, Tripura and Utkal along with IIT Kharagpur, Saha Institute of Nuclear Physics, S.N. Bose Institute of Basic Sciences, Indian Statistical Institute and the Birla Planetarium, Calcutta had general discussions centered around the objective of setting up facilities in optical and radio astronomies in the eastern region to mark the birth centenary of the great astrophysicist Meghnad Saha which falls in 1993. Talks were arranged as follows:

J.C. Bhattacharyya	—	Optical Astronomy
A.K. Kembhavi	—	Role of CCD in optical observations
K.D. Abhyankar & N.K. Dadhich	—	Teaching of astronomy in universities

(3) A Regional Discussion Meeting for the South-Central India region was held at Shivaji University, Kolhapur on September 15. Representatives from Ahmednagar College, College of Engineering (Sangli), H.P.T. College (Nasik), M.G.M. College (Udupi), along with these from the universities of Goa, Karnataka, Karnataka- Belgaum campus, Mangalore, Nagpur and S.K. University (Anantapur) and the host university had discussion on various IUCAA programmes. Need for introductory textbook in A and A was expressed for teaching in the universities and colleges. Current trends in astrophysics, gravitation and astronomical instrumentation were outlined by J.V. Narlikar, N.K. Dadhich and S.N. Tandon respectively.

Astrophysics School at Goa University

A school on Astrophysics was arranged at the Goa University during January 16-19. About 50 students from the colleges and university departments (Mathematics and Physics) in Goa attended the lectures. Recent advances in fields of cosmology, black holes, gravitational waves and instrumentation were covered by J.V. Narlikar, N.K. Dadhich, S.V. Dhurandhar, B.S. Sathyaprakash and Ranjan Gupta respectively.

M.Sc. Syllabus Meeting

On April 10, 1990 a meeting of experts was organised by IUCAA to decide the format of model M.Sc. syllabus for A and A specialization. It was decided to divide the course content into modules of 15 lectures each. It was proposed that there should be equal weightage to lectures, experiments and projects. Vacation project programmes for M.Sc. students and introductory and refresher courses in A and A for college and university teachers were also recommended by the expert committee.

Meeting of the UGC Committee on Astronomy Facilities in Universities

A Committee of the UGC met on February 22, 1991 to discuss how support can be generated during the VIII Plan for improving existing facilities and creating new ones in the university sector. A report of the Committee's deliberations and recommendations has been sent to the Chairman, UGC.

Publications

1] IUCAA Lecture Notes No. 1: Non-Perturbative Canonical Gravity by Abhay Ashtekar

2] Careers in Astronomy (Information brochure for students about opportunities available in the country in the area of A & A.)

3] Khagol: The IUCAA bulletin, Issues 2-5

Office Automation

The year has seen administrative staff using computerised systems like POP, FA in increasing their effectiveness and in supporting the academic programmes. Speedy purchase of material has contributed to the expansion of computing facilities and to the setting up of the Instrumentation Laboratory of IUCAA. The Accounts Automation Software is developed by M/s Algorhythms, Pune. The Travel System is in the design stage. After automation of other administrative areas like personnel, guest house management IUCAA office will achieve the goal of 'paperless office'.

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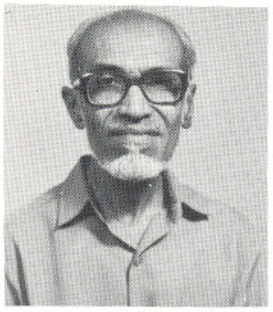
Senior Associates



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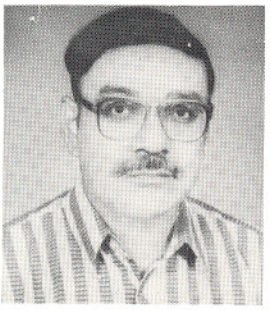

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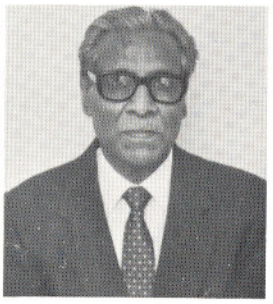
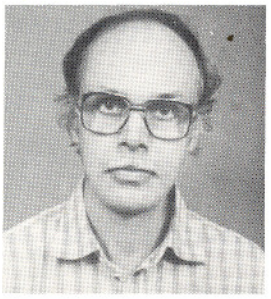


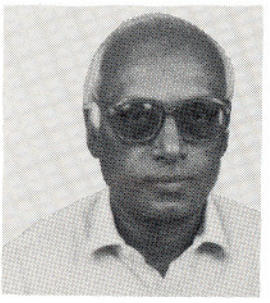
K.B. Bhatnagar

H.L. Duorah

A.N. Maheshwari



S. Mukherjee



N. Panchapakesan

L.K. Patel

V.R. Venugopal

S.D. Verma