

Information and Announcements



Inter-University Centre for Astronomy and Astrophysics (IUCAA)

Starting as an idea in 1987 and dedicated to the nation in 1992, IUCAA is probably the youngest astronomical institution in this country. Because of this youth, it is worthwhile to go over the motivations and objectives of this institution as well as its structure and achievements.

Astronomy and astrophysics have come a long way in the last few decades and research in these areas have become highly resource-dependent as regards manpower, observing facilities and computing. If Indian Universities were to participate in this exciting adventure on an individual basis, considerable investment would have been required in order to provide the necessary resources to even a select set. It was, therefore, felt that a worthwhile beginning could be the establishment of an Inter-University Centre in astronomy and astrophysics which could coordinate the efforts to nucleate astronomy research in the Universities and act as a field station for all the university staff in this country interested in astronomy and astrophysics. The University Grants Commission (UGC) established IUCAA with this motivation and has provided it with funding for facilities like computing, library, visitors programmes and an optical telescope (under construction). It is felt that Indian Universities, which are interested in developing astronomy and astrophysics activities of their own, could use IUCAA as a launch pad.

How does one translate this objective into a concrete plan of action? To begin with, IUCAA has a small – but growing – core faculty, postdocs and research students all of whom are engaged in basic research in A&A and participate in the teaching and developmental activities of the institution. The research is expected to be of international standards in order to maintain credibility as a national coordinating centre in activities related to astronomy and astrophysics.

While in this activity IUCAA may be similar to several other research institutions in this country, what sets it apart from other astronomy and astrophysics institutions is the fact that it is an Inter-University Centre (IUC). As a part of the above role, it is important that it takes



a lead in nurturing the culture of astronomical instrumentation and manpower training in astronomy and astrophysics in this country, especially in the university sector. IUCAA addresses this issue through several introductory and refresher courses at the university and college teachers' level. It also

holds several national and international conferences which members of the university sector are specially encouraged to attend. The participation of university faculty, in the national and international conference held here, is significantly higher than in similar conferences held elsewhere in India. IUCAA also organises lectures, seminars and minischools in university campuses all over the country with core faculty and postdocs of IUCAA participating actively. About 3–4 such programmes are organised each year.

IUCAA also has an extensive visitors programme aimed at closer interaction between the members of the university sector as well as between the university faculty and other experts in the field. It has nearly 500 visitors on an average per year and the university faculty are specially encouraged to make use of the expertise of visitors from abroad or from other institutions during their stay. To formalise the visitors activity in a systematic way, it has introduced an Associateship Programme for university faculty. Among those who apply, about 20 members of the university sector are selected every year as associates of IUCAA and are invited to spend about 12 months in a period of three years during this associateship. Full facilities are provided as regards travel, lodging etc. as a part of this programme so that their visit can be as comfortable as possible. At present, IUCAA has seventy associates from about forty different universities and colleges. It is hoped that the Associateship Programme will eventually lead to nucleation of active astronomy and astrophysics research at different universities in this country.

As another step in this direction, IUCAA plans to set up a few Regional Centres in astronomy and astrophysics in different parts of the country, around already existing active research groups. These centres will help introduce greater coherence among the university faculty in



the local region and will help them interact with IUCAA in a more coordinated and effective manner.

Finally, all these efforts tacitly assume that there is significant awareness and interest in astronomy and astrophysics in this country. While this is true to a certain extent, there is definitely scope for improvement. One possible way of enhancing this awareness in the community is through dedicated popular science programmes aimed at lay public and school and college students. IUCAA conducts a programme for school students in astronomy and astrophysics on two Saturdays each month and a project-oriented course during the summer vacation. These two activities, which have now been going on for five years, have been extremely successful and have drawn considerable amount of response from the schools in Pune.

It should also be noted that, by and large, observational facilities in India are not of international standard. To some extent this is because of inadequate training and motivation at the grassroots level in astronomical observation. IUCAA is currently building its own 2 metre telescope, to be located at Giravili (about 80 kms away from Pune). This telescope – in addition to being used in active astronomy research – will also provide a hands-on opportunity for the university community to learn the nuances of optical astronomy. Such exposure and experience will foster, in the long run, progress towards cutting-edge research in observational astronomy as well.

At present, IUCAA has 11 core faculty members, 11 students and 8 postdocs. The research activities of this academic staff covers a wide span of subjects in different areas of A&A.

In cosmology, the focus of research in IUCAA is on the formation of large scale structures. Over the last few decades, observational results have constrained theoretical models for galaxy formation quite severely. This fact, as well as the rapid growth in computer technology which allows one to simulate the nonlinear phases of evolution, have made the study of structure formation a thrust area in international research. Both analytical modeling and numerical simulation of the universe are carried out at IUCAA in order to understand different facets of this problem.

In extra galactic astronomy, research concentrates around observations of quasar absorption systems, their spectral analysis and the study of morphology of galaxies. Members of IUCAA participate in international collaborations and do their observations either on telescopes abroad or at different sites in India. The data analysis is almost entirely done at IUCAA.

Another major area in which IUCAA is involved in several international collaborations is in



the detection of gravitational waves. An active group at IUCAA has developed several new techniques related to the analysis of gravitational wave data as and when it becomes available. This work is done hand-in-hand with the leading research groups in the world who are building detectors for gravitational waves.

In the area of classical and quantum gravity there is a small but active group of people working on different aspects of general relativity. This work includes attempts to obtain non-singular classical solutions to Einstein's equations, different approaches to quantising gravity, investigations in string theory and blackhole physics.

Neural networks are extensively used in the study of classification of stellar spectra as a part of an ongoing programme of research in stellar structure, especially stellar atmospheres.

Another facet of astronomy which requires improvement in the Indian context is experimentation and instrumentation. The laboratory at IUCAA has been involved in the development of backend detectors for optical telescopes which, so far, have been used on many telescopes. The instrumentation laboratory is actively involved in activities related to the IUCAA telescope project.

IUCAA runs a Graduate School Programme in collaboration with NCRA, which is located nearby. About 3 students are selected each year in IUCAA for the Graduate Programme which leads to a PhD degree from Pune University. At the end of the first year of Graduate Course covering all the relevant topics in modern astronomy and astrophysics, the student joins a faculty member and continues with the PhD programme. Typically the PhD programme takes about 5 years for completion. So far, nine students have graduated from IUCAA in the last 9 years. Of these seven have got postdoctoral fellowships abroad, and two are working at other institutes in India.

IUCAA also selects about five to six postdoctoral fellows in different areas of astronomy and Astrophysics each year from applications received from all over the world. Every year, in the past five years or so, IUCAA has had at least one postdoc from abroad. IUCAA has had about twenty-eight postdoctoral fellows in 9 years. Postdocs who show remarkable academic excellence are absorbed into the core faculty of IUCAA within the first three years of their stay. Others are encouraged to find positions in the university sector, other institutions or to take up another postdoctoral fellowship elsewhere.

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