

# **Report on the ICTS-IIA Program “Extragalactic Relativistic Jets: Cause and Effect”**

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The International Centre for Theoretical Sciences (ICTS) - TIFR program on “Extragalactic Relativistic Jets: Cause and Effect”, which was organized in partnership with the Indian Institute of Astrophysics (IIA), was held on the new ICTS campus in Hesaraghatta, north Bangalore, from 12<sup>th</sup> to 20<sup>th</sup> October 2015. There were 93 registered participants along with a couple of ICTS members, who attended on some or all days of the program. A series of pedagogical lectures were conducted on the 12<sup>th</sup> and 13<sup>th</sup> of October. These talks were designed to introduce students and new members of the Jet astronomy community to topics that were to be discussed in the main science meeting, which took place from the 14<sup>th</sup> to the 17<sup>th</sup> of October. 18<sup>th</sup> October was left free for sight-seeing or interactions between the participants. Data-reduction tutorials on CASA (radio), NuSTARDAS (X-ray) and Fermi (gamma-ray) analysis were organized on the 19<sup>th</sup> and 20<sup>th</sup> of October.

## *Genesis:*

The program was conceived at the beginning of February 2015, primarily to recognize forty years of the discovery of the Fanaroff-Riley (FR) dichotomy in radio jets. ICTS's and IIA's institutional support made it possible for us to organize this international program in eight months. The scientific advisers of the program were Roger Blandford (Stanford), Garret Cotter (Oxford), C. H. Ishwara-Chandra (NCRA-TIFR), Ajit Kembhavi (IUCAA), Gopal-Krishna (Centre for Excellence in Basic Sciences), Robert Laing (ESO), Christopher O'Dea (Manitoba U.), Anthony Readhead (Caltech), Prajval Shastri (IIA) and Ashok Singal (PRL).

## *Content:*

The science meeting on 14<sup>th</sup> October started with a comprehensive introductory review by Robert Laing. Our current understanding of the Fanaroff-Riley dichotomy in radio jets, as well as jet phenomenology in general, were discussed. Talks included theoretical frameworks, results from observations and numerical simulations. Bernard Fanaroff, the co-discoverer of the FR dichotomy and current director of the Square Kilometer Array – South Africa, was an invitee to the meeting. The rest of the talks dwelt on various aspects of jet formation, jet propagation, jet properties (spectral indices, rotation measures and magnetic fields, morphology), jet diversity, host diversity, jet-medium interaction, and jet-impact on the surrounding interstellar/intergalactic medium. The summary talk of the science meeting was delivered by Roger Blandford. Bernard Fanaroff delivered a Public Talk on “Astronomy, Big Data and Human Capital Development” on the 16<sup>th</sup> of October. These talks (presentations and videos) and the posters are now online on the ICTS webpage.

The program was designed to initiate discussions and interactions, with long tea and lunch breaks. The student community was extremely active throughout the meeting and several questions were asked after each and every talk. This made the meeting very productive and engaging for all the participants.

## *Demographics - Participation:*

Of the 144 astronomers who registered for the program, 20 could not eventually attend, while 31 were placed in a waiting list mostly due to logistical constraints. Finally, 93 astronomers from India

and abroad took part in the program (one speaker delivered his talk via Skype from the USA). Indian participants made 63% of the total number of participants. The student fraction in the program was 31%, postdoc fraction was 21% and the faculty member fraction was 48%. 35% of the participants, 39% of speakers, 40% of the review talk speakers and 50% of the lecturers were female. Among the Indian participants, 24% were affiliated to Indian universities and colleges, while the remaining were affiliated to research institutes. Between 25 to 35 students, postdocs and faculty members attended the tutorial sessions, but the students were the primary attendees.

#### *Feedback:*

Feedback for the program was solicited from all the participants via email. Several participants have responded and the feedback has been overwhelmingly positive. Several students have written about how beneficial this meeting has been for them. They mention that clarification of concepts and exposure to debate were the primary ways they have benefited from the meeting. For many, it was their first international conference. The students and other participants appreciated the interaction with eminent as well as young astronomers from all over the world. The structure of the meeting facilitated a lot of discussion. As a result of which, data and images have been exchanged and new collaborative projects have been initiated. A couple of participants have mentioned that the tutorial sessions, especially for reducing radio data, should have been longer than one day. Radio data-reduction typically requires days and weeks to learn. We plan to have longer tutorial sessions for the radio data, in the future.