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Extragalactic Jets from Every Angle

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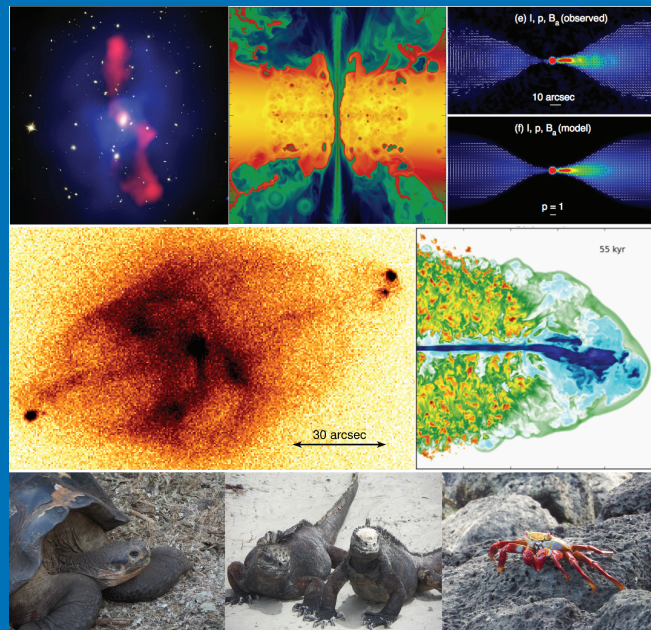
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EXTRAGALACTIC JETS FROM EVERY ANGLE

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COVER ILLUSTRATION MONTAGE, FAR TO NEAR:

Top row, left to right:

An example of a cavity system, MS 0735+74, at $z = 0.216$ (B. R. McNamara et al. 2005 *Nature*, 433, 45). The radio emission, shown in red (L. Bîrzan et al. 2008 *ApJ*, 686, 859) and the X-ray emission, shown in blue, are overlaid on an HST optical image. (Credit: X-ray: NASA/CXC/Univ. Waterloo/B. McNamara; Optical: NASA/ESA/STScI/Univ. Waterloo/B. McNamara). (See L. Bîrzan, these proceedings)

Edge-on logarithmic density distribution of the nuclear region of a Seyfert-like galaxy for the model (SNI+SB+JET) at $t=1.8$ Myr. (Credit: C. Melioli & E. de Gouveia Dal Pino, these proceedings)

Comparison between model and observations for the jets in NGC 315 (R. A. Laing & A. H. Bridle 2014 *MNRAS*, 437, 3405): (e) observed and (f) model images in which vectors with lengths proportional to the degree of polarization and directions along the apparent magnetic field are superposed on false-colour total intensity. (Credit: R. Laing & A. Bridle, these proceedings)

Middle row, left to right:

Background subtracted, exposure corrected 0.5 - 7 keV Chandra image of Cygnus A. (Credit: P. Nulsen et al., these proceedings)

Interaction of a relativistic jet with the interstellar medium; evolution after 55 kyr. (Credit: G. Bicknell et al., these proceedings)

Bottom row, left to right:

Photographs taken in Puerto Ayora, Galapagos during the symposium: saddle type tortoise, marine iguanas, and red rock crab. (Credit: Tamela Maciel)

IAU SYMPOSIUM PROCEEDINGS SERIES

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Preface

Extragalactic jets provide the direct observational evidence for a connection between supermassive black holes and their surrounding cosmic environments. They deliver the energy released by an accreting black hole to large distances and impact the formation and evolution of surrounding structures. The significance of relativistic jets is visible on many physical scales and in a variety of astrophysical sources. They carry information about the black hole power, spin, accretion state and characteristic timescales, and probe the environment beyond the black hole's immediate sphere of influence.

In recent years, both space- and ground-based telescopes are providing new insights to investigate jet physics. New data on jets have been accumulating from space missions such as *Swift*, *XMM-Newton*, *Chandra*, *Suzaku*, *Fermi*, *Hubble*, *Spitzer*, and WISE. Upgraded and future ground-based facilities such as JVLA, ATCA, ALMA, LOFAR and SKA will provide higher quality data at both the lowest and highest radio frequencies. At higher energies, the atmospheric Cherenkov telescopes, HESS, MAGIC, and VERITAS have provided evidence indicating rapid time variability in jets, and in the future these facilities will be augmented by CTA. Although we are now living in a “golden age” and despite the recent progress, many new and unsolved problems specific to the physical mechanisms underlying jet physics are still under debate.

This is an excellent time to bring together observational astronomers working across the electromagnetic spectrum with theorists to address the pressing questions concerning our understanding of the physics of relativistic jets. The open questions to be addressed include unification scenarios for blazars and radio galaxies, the interactions between jets and their environments, the composition and structure of jets and the mechanisms leading to their collimation, the role of magnetic fields, the mechanisms of particle acceleration in jets, the production sites of high-energy emissions, and the scaling of physical jet phenomena with black-hole mass, from extragalactic to Galactic sources.

These are the topics addressed in the IAU Symposium 313: “*Extragalactic Jets from every angle*” (Galapagos 2014).

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 Preeti **Kharb**, Indian Institute of Astrophysics, India
 John **Kirk**, MPI für Kernphysik, Germany
 Evgeniya **Kravchenko**, Astro Space Center of Lebedev Physical Institute, Russia
 Magdalena **Kunert-Bajraszewska**, Toruń Centre for Astronomy, Poland
 Robert **Laing**, European Southern Observatory, Germany
 Glen **Langston**, National Science Foundation, USA
 Stefan **Larsson**, Stockholm University, Sweden
 Robert **Lauer**, University of New Mexico, USA
 Jonathan **León-Tavarez**, INAOE, México
 Elina **Lindfors**, Tuorla Observatory, Finland
 Mikhail **Lisakov**, Astro Space Center of Lebedev Physical Institute, Russia
 Mario **Llerena**, Quito Astronomical Observatory, Escuela Politécnica Nacional, Ecuador
 Ericson **Lopez**, Quito Astronomical Observatory, Escuela Politécnica Nacional, Ecuador
 Benoit **Lott**, Université de Bordeaux, France
 Pedro **Luque-Escamilla**, Universidad de Jaén, Spain
 Tamela **Maciel**, University of Cambridge, UK
 Elizabeth **Mahony**, ASTRON, The Netherlands
 Julien **Malzac**, Université de Toulouse and IRAP, France

Antonio **Marinelli**, Universidad Nacional Autónoma de México, México
 Alan **Marscher**, Boston University, USA
 Herman **Marshall**, Massachusetts Institute of Technology, USA
 Francesco **Massaro**, Yale University, USA
 Walter **Max-Moerbeck**, National Radio Astronomy Observatory, USA
 John **McKean**, ASTRON, The Netherlands
 Claudio **Melioli**, IAG-Universidade de São Paulo, Brazil
 Giulia **Migliori**, Harvard-Smithsonian Center for Astrophysics, USA
 Felix **Mirabel**, Centre de Saclay, France
 Leah **Morabito**, Leiden Observatory, Leiden University, The Netherlands
 Raffaella **Morganti**, ASTRON and University of Groningen, The Netherlands
 Brian **Morsony**, University of Wisconsin - Madison, USA
 Monika **Mościbrodzka**, Radboud University, The Netherlands
 Juliana **Motter**, Universidade de São Paulo, Brazil
 Cornelia **Mueller**, University of Wuerzburg, Germany
 Neil **Nagar**, University of Concepcion, Chile
 Susan **Neff**, NASA Goddard Space Flight Center, USA
 Danielle **Nielsen**, University of Wisconsin - Madison, USA
 Jacek **Niemiec**, Instytut Fizyki Jadrowej PAN, Poland
 Paul **Nulsen**, Harvard-Smithsonian Center for Astrophysics, USA
 Shane **O'Sullivan**, University of Sydney, Australia
 Alejandro **Olguín Iglesias**, INAOE, México
 Alessandro **Paggi**, Harvard-Smithsonian Center for Astrophysics, USA
 Victor **Patino-Álvarez**, INAOE, México
 Timothy **Pearson**, California Institute of Technology, USA
 Vahe' **Petrosian**, Stanford University, USA
 Richard **Plotkin**, University of Michigan, USA
 Tapio **Pursimo**, Nordic Optical Telescope, Spain
 Jonathan **Quirola**, Escuela Politécnica Nacional, Ecuador
 Arvind **Ramessur**, Hartebeesthoek Radio Astronomy Observatory, South Africa
 Scott **Randall**, Harvard-Smithsonian Center for Astrophysics, USA
 Joseph **Richards**, Purdue University, USA
 Gustavo **Romero**, Instituto Argentino de Radioastronomía, Argentina
 Tullia **Sbarrato**, INAF - Osservatorio Astronomico di Brera, Italy
 Daniel **Schwartz**, Harvard-Smithsonian Center for Astrophysics, USA
 Nigel **Sharp**, National Science Foundation, USA
 Prajval **Shastri**, Indian Institute of Astrophysics, India
 Aneta **Siemiginowska**, Harvard-Smithsonian Center for Astrophysics, USA
 Marek **Sikora**, Nicolaus Copernicus Astronomical Center, Poland
 Howard **Smith**, Harvard-Smithsonian Center for Astrophysics, USA
 Randall **Smith**, Harvard-Smithsonian Center for Astrophysics, USA
 Malgorzata **Sobolewska**, Nicolaus Copernicus Astronomical Center, Poland
 Kirill **Sokolovsky**, Astro Space Center of Lebedev Physical Institute, Russia
 Rhanna **Starling**, University of Leicester, UK
 Lukasz **Stawarz**, ISAS - JAXA, Japan
 Iurii **Sushch**, North-West University, South Africa
 Gianpiero **Tagliaferri**, INAF - Osservatorio Astronomico di Brera, Italy
 Alexander **Tchekhovskoy**, UC Berkeley, USA
 Christina **Thöne**, Instituto de Astrofísica de Andalucía - CSIC, Spain
 Grant **Tremblay**, Yale University, USA
 Sara **Turriziani**, Università degli studi di Roma "Tor Vergata", Italy
 Carlos **Velásquez**, Quito Astronomical Observatory, Escuela Politécnica Nacional, Ecuador
 Andrea **Vinueza**, Quito Astronomical Observatory, Escuela Politécnica Nacional, Ecuador
 Thomas **Vuillaume**, Institut de Planétologie et d'Astrophysique de Grenoble, France
 Anna **Wolter**, INAF - Osservatorio Astronomico di Brera, Italy
 Diana **Worrall**, University of Bristol, UK
 Kenji **Yoshida**, Shibaura Institute of Technology, Japan
 Andrzej **Zdziarski**, Nicolaus Copernicus Astronomical Center, Poland

Address by the Local Organizing Committee

Dear colleagues,

Escuela Politécnica Nacional of the Republic of Ecuador through its Quito Astronomical Observatory is pleased to welcome scientists, researchers, academics and scientific representatives, coming from around the world to participate with their scientific contributions in the International Astronomical Union (IAU) Symposium 313 “*Extragalactic jets from every angle.*”

We are proud that this important IAU meeting is being held in the Galapagos Islands, an archipelago of volcanic islands distributed on either side of the Equator in the Pacific Ocean, 926 km west of continental Ecuador, of which they are a part.

This is a very important meeting in which the scientific community will present and discuss recent advances in the understanding of black hole / extragalactic jet connections, multi-frequency observations of highly variable relativistic jets, jet interactions, cosmological evolution of jet progenitors, particle acceleration mechanisms, cosmic rays and high-energy radiative processes, jet structure, launching jets, extragalactic and galactic jet synergies, and extragalactic jets in the SKA, LSST, and CTA era.

This high level scientific event has been carefully organized and planned for a long time with dedication and care. Its program has been enriched with an abundance of interesting important scientific contributions, which certainly will bring much benefit to each of the participants. We are here to ensure the successful realization of the Symposium to enable further research in the field and for new collaborations to begin.

This important symposium in extragalactic jets is held in a unique place – the enchanted Galapagos Islands. We hope that this Symposium occurring in Ecuador becomes part of the historical International Astronomical Union scientific meetings, in which the astronomy world is consolidated. We are thankful for the valuable support of the International Astronomical Union, and the support of its related divisions and committees to whose members we express our deep appreciation. In the same spirit, our acknowledgments to the host institution Escuela Politécnica Nacional and its authorities for the continuous support and necessary facilities that have allowed the organization and realization of the symposium on the islands, far from the mainland. The local support by the personnel of Santa Cruz Municipality and the Mayor Leopoldo Bucheli has been crucial, and we are grateful for the cooperation provided.

Also, I would like to express our special thanks to each of the chairs of the scientific organizing committee (SOC): to Dr. Francesco Massaro, Dr. Teddy Cheung and Dr. Aneta Siemiginowska, for their valuable support and hard work over nearly two years making the realization of this important scientific meeting possible. We extend our thanks to the members of the SOC for their diligent work in helping to form the scientific rationale and the program for the meeting. In the same context, our gratitude to all participants of this Symposium for the tremendous effort to come to Ecuador and Galapagos Islands in order to be part of this great symposium.

I wish you all enjoy the meeting in all respects. I wish every participant find fruitful results beyond those that everyone expected. Welcome to all participants of the IAU Symposium 313 “*Extragalactic jets from every angle.*”

*Ericson López, chair LOC
Director, Quito Astronomical Observatory
September 15, 2014*

Address by the Scientific Organizing Committee

The IAU Symposium 313 entitled “*Extragalactic Jets from Every Angle*” (Galapagos 2014), took place in the Puerto Ayora town, capital of the Galapagos Province of Ecuador, located on the Santa Cruz island. This meeting was the culmination of efforts by the Scientific and Local Organizing Committees that began almost two years ago at its conception in the halls of the Harvard-Smithsonian. Our principal aim was to bring together the community of jet researchers to synthesize the collected knowledge in order to confront outstanding problems in the field. We are so happy to have taken this unique occasion to celebrate the 80th birthday of our colleague, mentor, and friend, Daniel E. Harris, and his many contributions to research on extragalactic jets over the past half-century.

We thank the members of the Scientific Organizing Committee for their work from the original formation of the proposal to the IAU through to the finalization of the science program. We benefitted from the support of the IAU, the Assistant General Secretary, Piero Benvenuti, and endorsements from the Presidents of Divisions D (Diana Worrall), J (Francoise Combes), and B (David Silva), and Commissions 40 (Jessica Chapman), and 44 (Christine Jones).

To the Local Organizing Committee, we are grateful for their diligent work that made this meeting possible, particularly Ericson Lopez for his leadership. The atmosphere of the town and its people were most welcoming, and we were incredibly fortunate to have received the support and hospitality of the Santa Cruz Municipality and Mayor Leopoldo Bucheli in providing us the use of the municipal auditorium.

The many participants made this meeting a success, having journeyed over the vast distances to start the symposium on September 15th. That same day in 1835, Darwin in his *Voyage of the Beagle* similarly began his Chapter on the Galapagos Archipelago, and his musings thereafter changed our modern view of human history. We hope that the participants will draw their own inspiration from their time spent on the magical islands.

*Francesco Massaro, Teddy Cheung, Ericson Lopez, Aneta Siemiginowska, co-chairs SOC
Puerto Ayora, Galapagos Islands
September 19, 2014*