

Conference Highlights

The Central Kiloparsec of Starbursts and Active Galactic Nuclei: The La Palma Connection¹

From 2001 May 7 to 11, the Hotel Hacienda San Jorge in the small resort town of Los Cancajos on La Palma was filled with astronomers studying the central kiloparsec regions of starbursts and active galactic nuclei (AGN). La Palma is one of the smallest of the Spanish Canary Islands and is well known for its world-class astronomical observatory at the Roque de los Muchachos. The main telescopes operated there are the Isaac Newton Group's 4.2 m William Herschel Telescope and the Italian 3.5 m Galileo National Telescope (TNG), while Spain is presently constructing its 10.4 m Gran Telescopio Canarias (GTC). In spite of a strong astronomical presence of at least two decades, this was the first scientific astronomy conference organized completely on La Palma. The fact that many high-resolution studies of galaxies have been made using data obtained on La Palma makes the island a fitting "connection" to the field of study. The meeting was attended by 120 astronomers from 15 countries, while a number of people had to be disappointed because the capacity of the hotel and conference room would not allow more attendees. The program was full and included nine oral and two poster sessions, long lunch breaks, which were often used for further discussions or collaborative work, and a number of social events. Most of those attending participated in a guided tour of the telescopes at the Observatory on the Wednesday afternoon.

Recent advances in high-resolution observations, theory, and modeling have focused our attention on the central kiloparsec regions of nearby disk galaxies, which often show profound starburst and/or nonstellar (AGN) activity, accompanied by intricate gas and dust morphologies and kinematics. The origin and evolution of the phenomena occurring in these central regions, their possible causal interrelationships, links to the host galaxies, and the role the central regions play in galaxy evolution were the main topics under consideration.

The meeting brought together researchers in a variety of specialties, who could concentrate on a relatively restricted part of the complete field. This focused the discussions and led to a very productive exchange of ideas. One of the topics covered in detail was the connection between an AGN and a starburst, which are present simultaneously in a sufficient fraction of cases to have stimulated the hypothesis that if they are not the same phenomenon, at least there might be a causal relation between them. There is now convincing evidence from obser-

vations across the spectrum for this, and the meeting brought to bear many new examples, including beautiful new results obtained with orbiting X-ray observatories. It is now accepted that AGN and starburst activity often occur together, and this strengthens the view that the two phenomena are triggered and fueled by common mechanisms. No direct causal relationships or clear evolutionary scenarios between AGN and starbursts have yet emerged, but we are progressing quickly and can expect to find them if they are in fact present.

Many detailed studies of the physics of star formation and nonstellar activity were presented during the meeting, both theoretical and observational, the latter using tracers at wavelengths ranging from the X-ray to the radio domains. These included investigations of the mechanisms that form jets in disks, of the torus and narrow- and broad-line regions in AGN, of the role of magnetic fields in the central kiloparsec, and of the mechanisms leading to enhanced star formation at specific locations and times. Important new results, both from observations and from population synthesis modeling, were presented on the properties and especially the ages of the stellar clusters found in starburst regions, either central or circumnuclear.

The relations between an AGN and the properties of its host galaxy were explored at length, albeit without reaching clear conclusions. There is now further evidence for a significant though weak trend for Seyfert galaxies to be more often barred than non-Seyfert galaxies. Many beautiful and detailed numerical and observational studies of the morphology and kinematics of nuclear bars, rings, and spiral arms were presented, but, perhaps disappointingly, no direct links to AGN fueling were discovered. It is possible, and theoretically quite plausible, that any relation between circumnuclear and host galaxy structure and the presence or properties of an AGN may be weakened by the tendency of a central, or circumnuclear, mass concentration to dissipate the bar that originally induced it.

Following notable recent observational advances, the relationship between supermassive black holes, which are assumed to drive the AGN, and their surrounding spheroidal component structures (the whole galaxy for an elliptical, and the bulge for a spiral) received considerable attention. A related topic, the relation between local gas density and star formation rate, was discussed starting from conclusions based on its conventional context—galactic disks—and the participants went on to discuss the implications for circumnuclear zones. A theoretical and observational attack on this problem would in all probability go a

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long way toward explaining why there is AGN activity around some supermassive black holes but less or none around others.

In general, it was heartening to see real progress being made across the field thanks notably to a continuing stream of *Hubble Space Telescope* observations, to X-ray results obtained with new orbiting observatories, but also to imaging and spectroscopy from ground-based optical/near-infrared telescopes, such as those on La Palma. In addition, numerical simulations of gasdynamics are progressing quickly, reaching higher dynamical and spatial resolution and deepening our insight into a range of physical processes.

Any conference proceedings necessarily provides a snapshot of the state of a given field, which makes it appear perhaps more static than it really is. In this field, we do foresee a

continuing, even increasing, high rate of research leading to important breakthroughs both observationally—because of new instrumental opportunities allowing observation at higher angular resolution, sensitivity, area coverage, and wavelength coverage—and theoretically—because of continuing major refinements in modeling. We trust that the proceedings of the present conference will, then, offer not only a fixed photograph of the present but a useful, even prophetic guide to the future of this exciting and changing subject.

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