

The Nuclei of Normal Galaxies

Lessons from
the Galactic Center

Edited by

R. Genzel and A. I. Harris

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Garching bei München, Germany



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PREFACE

Our Galactic center's proximity allows astronomers to study physical processes within galactic nuclei at a level of detail that will never be possible in the more distant, but usually also more spectacular, extragalactic systems. Recent advances in instrumentation from the radio, through the submillimeter and infrared wavebands, and out to the X- and γ -ray bands now allow observations of the Galactic Center over thirteen orders of magnitude in wavelength. Our knowledge about the central few hundred parsecs of our Galaxy has consequently increased vastly over the past decade. The same new instruments provide high resolution, high quality measurements of nearby "normal" galactic nuclei; that is, nuclei whose modest energy output is comparable to that of our own (and most other) galaxies. Theorists, spurred in part by the new observations, have been able to refine models of the energetics, dynamics, and evolution of the gas and stellar systems deep within galactic nuclei.

In view of this tremendous progress, we had two principal scientific goals for the NATO Advanced Study Institute "The Nuclei of Normal Galaxies: Lessons from the Galactic Center" (July 26 - 30, 1993). First, it was our intention to review and discuss the vast new body of observations of the Galactic Center that have accumulated in the relatively short time since the last major conference devoted to this topic (the IAU symposium 136 in Los Angeles in 1988). Second, we wanted to provide a forum for bringing the Galactic Center results in perspective with the findings in external galaxies and for discussing how well the Galactic Center can serve as a "model laboratory."

To stimulate intense, uninterrupted interactions between researchers coming from different communities (from γ -ray to radio) and backgrounds (observers and theoreticians, Galactic and extragalactic) we chose the framework of a NATO Institute and the setting of the Schloß Ringberg retreat of the Max-Planck Society, located high above Tegernsee in the Bavarian Alps. Sixty-five scientists from ten countries participated in the Study Institute, balanced between many well known experts in the various topics of the meeting and a healthy number of Ph.D. students and young postdocs.

The conference featured 14 review talks (of 30 minute duration), 5 invited highlight talks (20 minutes), and 20 contributed talks (15 minutes). In ad-

dition, a special evening session was devoted to the 22 posters that were on display during the entire conference. Two informal round table discussions (on the dynamics of the ionized gas in the inner parsec and on the core radius of the Galactic Center stellar cluster) sprang up as the result of discussions after the talks, for which ample (but perhaps still not enough) time had been allotted.

The conference topics evolved from large (10^2 to 10^3 pc) to small (≤ 1 pc) scales, always juxtaposing results obtained with different techniques, inside and outside of our Galaxy, as well as theory. The first morning was devoted to stellar bulges and to the molecular gas conditions and dynamics on $\geq 10^2$ parsec scales, followed by recent X-ray and γ -ray results in the afternoon. The stellar component and the interstellar medium, including the role of magnetic fields, on scales of a few tens to 100 parsecs were the topics of the mornings of the second and third days. The afternoon of the second day was free for informal discussions during walks in the mountains or along the Tegernsee. The afternoon of the third day dealt with nuclear stellar clusters and with the issue of rapid massive star formation in these dense environments. The morning of the fourth day was devoted to recent high resolution optical, infrared and radio imaging of the nucleus (a few tens of parsec), and a discussion of the gas dynamics. This was followed by the conference excursion in the afternoon. The fifth and last day featured talks on the dynamics and evolution of the innermost (1 pc) stellar cluster, on the interpretation of the central radio source and on the evidence for and against central massive black holes. The conference was then brought into perspective by the final speaker, Prof. C.H. Townes.

The conference was also held to honor Prof. Peter G. Mezger, scientific director at the Max-Planck-Institut für Radioastronomie in Bonn, on the occasion of his 65th birthday. Peter Mezger has been the prime driving force of German radio astronomy of the last 20 years, and dedicating this conference to him is highly appropriate because the Galactic Center has been, and continues to be, one of his main research areas. We celebrated Peter's birthday (which actually took place on November 19, 1993) during the conference banquet. Jim Moran gave the after dinner talk, describing some of the history and high points of Peter Mezger's career and most important discoveries, along with an entertaining account of the development of US and German radio astronomy. We include a both a writeup of Jim Moran's speech and a complementary contribution from D. Heeschen, who wanted to present it personally at the conference but was unfortunately unable to attend. Peter's well known athletic interests were acknowledged by providing him with a set

of 65 tennis balls signed by the participants, along with a climbing rope for his future vertical exploits in the Alps of Bavaria and elsewhere.

We wish to thank a number of individuals who have made this NATO Institute as successful as it was. The Scientific Organizing Committee, consisting of D. Allen, R. Genzel (Chair), T. Heckman, K.Y. Lo, P.G. Mezger, M. Morris, M. Rees, G.H. Rieke, Y. Sofue, R. Sunyaev, and C.H. Townes, was responsible for the programmatic decisions and for the selections of all speakers. The Local Organizing Committee consisted of M. Cameron, R. Genzel, S. Harai, A. Harris (Chair), A. Krabbe, A. Poglitsch, and B. Schnelle. We would like to especially thank the conference secretaries, Susanne Harai and Barbara Schnelle, for their long hours of organizing, communicating, inquiring, solving problems, and all the other tasks that are so plentiful both before and during such a conference. It is also a pleasure to thank F. Hörmann and the staff of Schloß Ringberg for their professional and efficient operation of the conference center and its kitchen, including on-the-spot solutions to unexpected and unplanned situations. Finally we would like to thank the director of the Garmisch-Partenkirchen forest service, Herr Forstdirektor G. Gleißner, for unbureaucratically giving us the permission to drive the buses of our excursion past the public barriers of the trail to the Schachen hunting lodge.

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R. Genzel and A. Harris, Garching, May 1994

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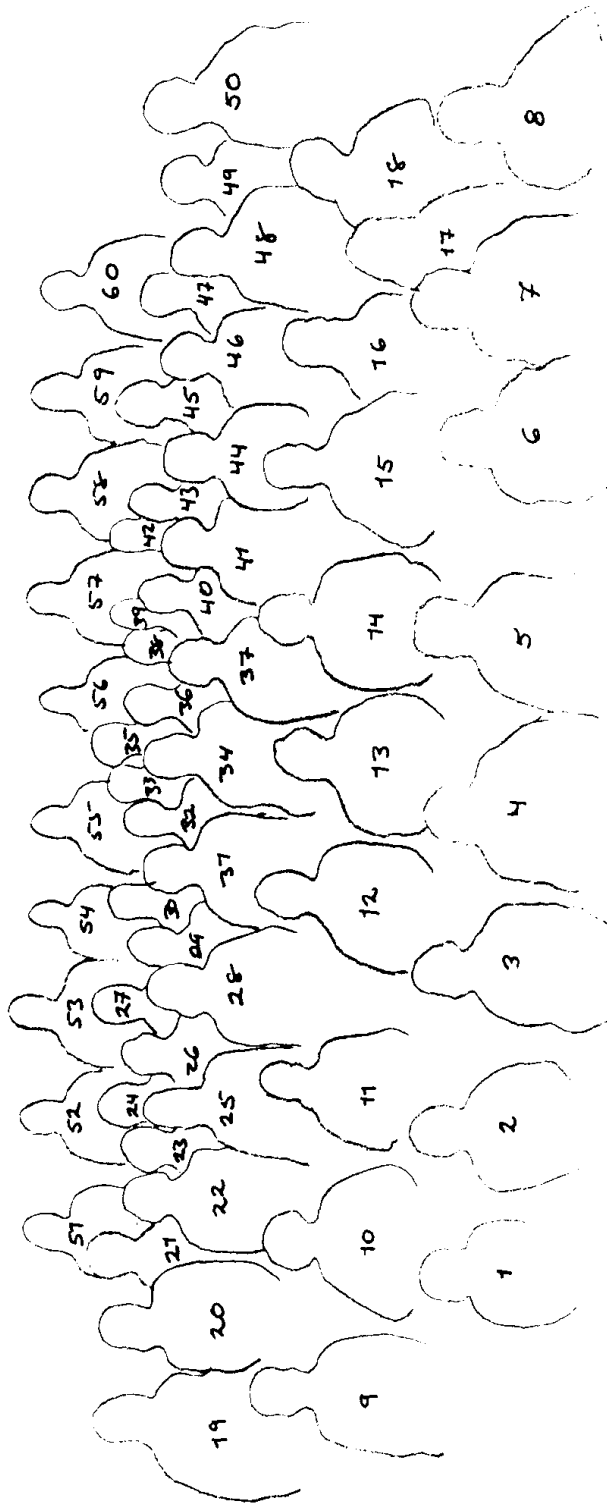
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