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Arturo Manchado
Letizia Stanghellini
Detlef Schönberner

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PLANETARY NEBULAE: AN EYE TO THE FUTURE

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COVER ILLUSTRATION: Mount Teide view taken from the Teide observatory.

Mt. Teide, located on Tenerife in the Canary Islands, measures 7500 meters from its base on the ocean floor to its peak, making it the third highest volcano in the world. It is an active volcano, and its most recent eruption occurred in 1909. The volcano and its surroundings comprise the Teide National Park, which was named a World Heritage Site by UNESCO on June 29, 2007. This stunning park is one of the most visited National Parks in the world.

Image credit: Miguel Briganti, IAC

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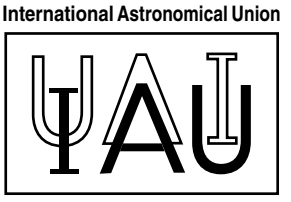

PLANETARY NEBULAE AN EYE TO THE FUTURE

PROCEEDINGS OF THE 283rd SYMPOSIUM OF THE INTERNATIONAL ASTRONOMICAL UNION HELD IN PUERTO DE LA CRUZ, TENERIFE, SPAIN JULY 25–29, 2011

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Preface

Planetary Nebulae (PNe) play a key role in stellar evolution; an important fraction of stellar matter in the Universe (stars in the approximate range of 1–8 $M_{\odot}$), low- and intermediate-mass stars), go though the asymptotic giant branch (AGB) and PN phases in their lifetime, thus understanding their working is essential. Observationally, most known PNe are the progeny of the lower mass end, since the dynamical PN phase of the PNe with massive progenitors is intrinsically very short and thus less populated, whereas the high-mass end of the low- and intermediate-mass stars is observed at early stages, when they appear as embedded AGB stars. PNe are major contributors to the chemical enrichment of the galaxies, especially where nitrogen and carbon are concerned. PNe are multi-wavelength laboratories for the understanding of atomic, molecular, dust, and plasma processes in different astrophysical environments. The means by which the wonderfully diverse morphologies of PN originate and evolve, including hydrodynamical shaping mechanisms and the role of binarity, magnetic fields and rotation, make them essential to constrain hydrodynamics models and advanced stellar evolutionary calculations. PNe influence the interstellar media of galaxies, enriching them chemically; and they are a tool for studying the dynamics and mass distributions of galaxies and the intergalactic media of clusters of galaxies.

Research on PNe has undergone vigorous growth in recent years, between 2003 and 2008 the number of published papers has more than doubled.

The PN community has enjoyed an ongoing history of successful IAU symposia, beginning with IAU Symp. 34 in Tatranska Lomnica, Czechoslovakia in 1967, followed by IAU Symp. 76 in Ithaca, N.Y., U.S.A. in 1977, IAU Symp. 103 in London, England in 1982, IAU Symp. 131 in Mexico City, Mexico in 1987, IAU Symp. 155 in Innsbruck, Austria in 1992, IAU Symp. 180 in Groningen, Holland in 1996, IAU Symp. 209 in Canberra, Australia in 2001, and IAU Symp. 234 in Hawaii, USA in 2006. In Hawaii 2006, the PN Working Group unanimously endorsed the invitation of Mario Perinotto to hold the next IAU Symposium in Firenze (Italy). However, his untimely death in 2007 not only was a great loss to the PN community, it also meant that another venue for the Symposium had to be found. Later, at a meeting of the PN Working Group at La Palma in June 2007, in response to an invitation by Dr. A. Manchado of the Instituto de Astrofísica de Canarias, the working group members unanimously voted in favor of Tenerife, Spain, as the site of the next IAU Symposium on PN. This recognizes the significant contributions made by Spanish astronomers to the field of PN research. In fact, La Palma, Spain, has become one of the most important astronomical observatory sites in the world, with the inauguration of the GTC 10.4 meter telescope.

The program was carefully put together by the Scientific Organizing Commitee, whose members were Mike Barlow (U.K.), You-Hua Chu (U.S.A.), Romano Corradi (Spain), Shuji Deguchi (Japan), Adam Frank (U.S.A.), George Jacoby (U.S.A), Sun Kwok (China), Alberto López (México), Walter Maciel (Brazil), Arturo Manchado (Spain, co-Chair), Roberto Méndez (U.S.A.), Quentin Parker (Australia), Detlef Schönberner (Germany), Letizia Stanghellini (U.S.A., co-Chair), and Albert Zijlstra (U.K.)

IAU Symposium 283 was held from July 25-29 2011 at Puerto de la Cruz on Tenerife in the Canary Islands, Spain. One hundred and fifty-seven participants from 26 countries from the five continents interacted and discussed the many different aspects and facets of the planetary nebulae field. The meeting included 24 invited review papers (30+5 minutes), 30 oral contributions (20+5 minutes) and 139 poster presentations. The reception

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took place on the evening of Sunday July 25th in the Taoro Conference Center, the venue for the Symposium.

The Local Organising Committee, consisting of Judith de Araoz, Eva Bejarano, Romano Corradi, Anibal García-Hernández, Valentina Luridiana, Arturo Manchado (Chair), Christophe Morisset and Eva Villaver provided a very efficient operation that was warmly appreciated by all participants.

The broad meeting themes included surveys of PNe; aspects of the PNe phase; the central stars; the population of galactic, extragalactic, and intra-cluster PNe; and future endeavours in the field.

Some of the most significant highlights of this meeting were:

• The results from IPHAS: The INT/WFC Photometric Hα Survey of the Northern Galactic Plane was completed, allowing the discovery of 155 new PNe.

• New results from the HERSCHEL satellite were presented; e.g., new large detached shells around AGB stars formed by the interaction of the AGB mass loss with the ISM and the discovery of water vapor in a carbon rich-AGB star.

• Large carbon molecules, the so-called fullerenes (C60 and C70), were detected around PNe in the Milky Way and in nearby galaxies such as the Magellanic Clouds. These fullerenes, the biggest molecules known in space, have been detected accompanied by large concentrations of hydrogen, contradicting the actual theories and the laboratory experiments, which show that fullerene formation is strongly inhibited by hydrogen. It turns out that fullerenes are much more common and abundant in the Universe than initially thought, with important implications to circumstellar/interstellar chemistry and physics. In addition, graphene (planar C24) has been detected for the first time in some PNe with fullerenes.

• The relationship between uncertainties in atomic data and the resulting uncertainty in derived abundances was discussed. Such relationships can be articulated in a few specific questions, such as: Do uncertainties in atomic data matter in chemical abundance calculations? How large are they? Why are they not usually specified in the papers that describe them? Can they be estimated somehow? How can I decide between two conflicting data sets? And, most important of all, how will the choice affect the final results?

• A "Kinematic Catalogue of Galactic Planetary Nebulae" that consists of high resolution (between 6 and 11.5 km s^{-1}) spectra of about 600 planetary nebulae was completed.

• 3-D models of the common envelope phase were presented.

• New results from MC and local group galaxies were presented, allowing the faint end of the luminosity function to be investigated.

Financial support from the IAU, the Spanish Ministry of Science and Innovation (MICINN), the Island Council (Cabildo Insular) of Tenerife and the Instituto de Astrofísica de Canarias (IAC) made this meeting possible.

Arturo Manchado, Letizia Stanghellini and Detlef Schönberner, editors of the IAU 283 proceedings

La Laguna, Tucson, Potsdam, May 20, 2012

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The Local Organizing Committee operated under the auspices of the Instituto de Astrofísica de Canarias.

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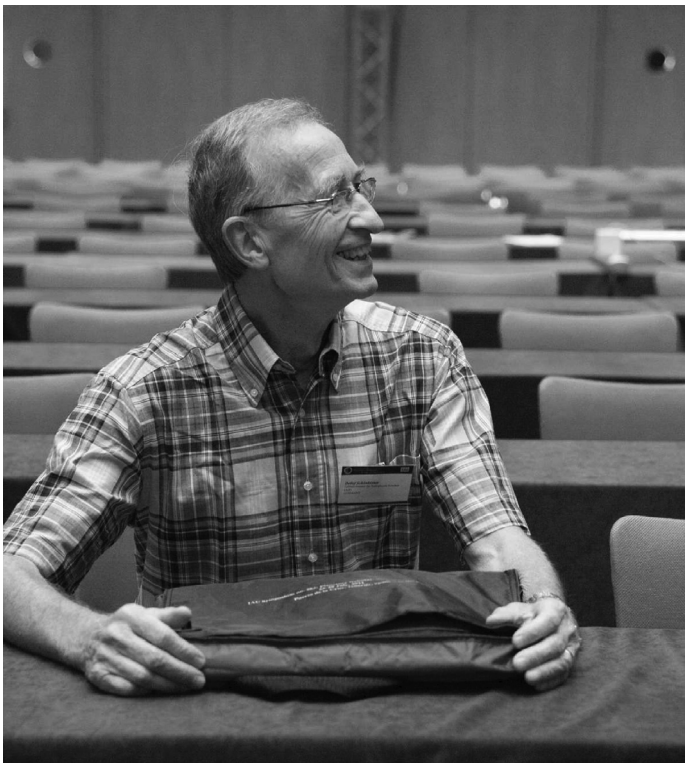

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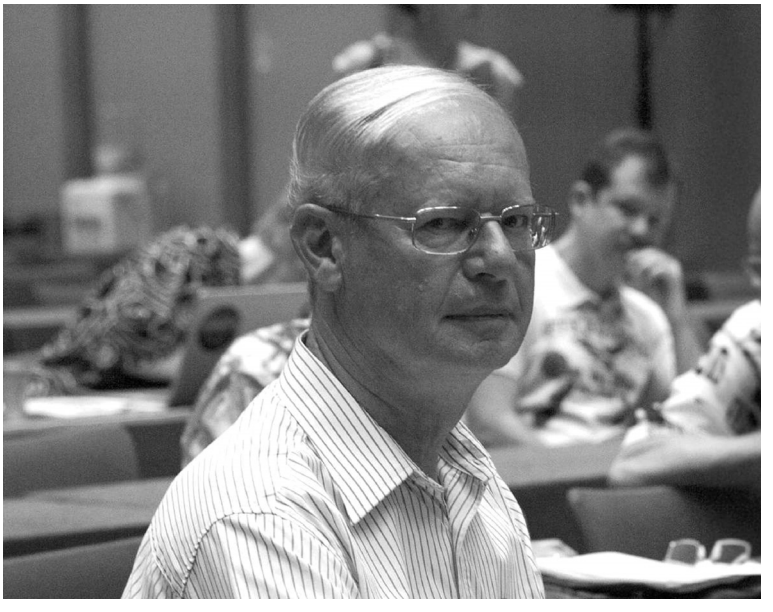

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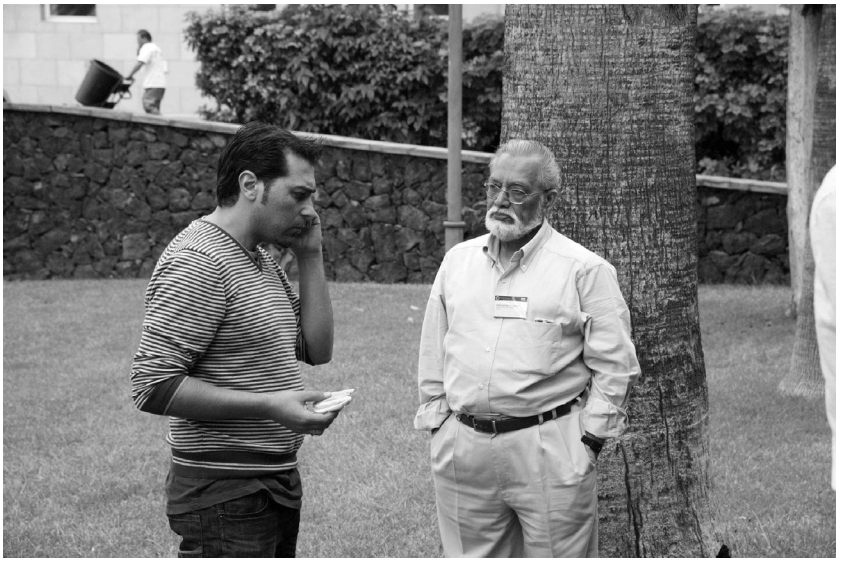

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