



**Science with 8-10m telescopes
in the era of ELTs and the JWST**
Seminar Proceedings: 25/26 July 2009, La Palma



Science with 8-10m telescopes in the era of ELTs and the JWST



Scientific Organizing Committee

**Francisco Sánchez Martínez
José Miguel Rodríguez Espinosa
Rafael Rebolo López**

**Coordinador de la edición
Campbell Warden**

Instituto de Astrofísica de Canarias - IAC

**Science with 8-10m telescopes
in the era of ELTs and the JWST**



Reservados todos los derechos.

Ni la totalidad ni parte de este libro pueden reproducirse o transmitirse por ningún procedimiento electrónico o mecánico, incluyendo fotocopia, grabación magnética, o cualquier almacenamiento de información y sistema de recuperación, sin permiso escrito de Editorial Centro de Estudios Ramón Areces, S.A.

© Editorial Centro de Estudios Ramón Areces, S.A.

Tomás Bretón, 21 - 28045 Madrid

Teléfono: 915061190

Fax: 915390730

Correo: cerasa@cerasa.es

Web: www.cerasa.es

© Fundación Ramón Areces

Vitruvio, 5 - 28006 Madrid

Web: www.fundacionareces.es

Diseño y maquetación: Gotzon Cañada

Foto portada: Pablo Bonet

Instituto de Astrofísica de Canarias

38200 La Laguna

Tenerife - Spain

+34 922 605 220

director@iac.es

Fotocomposición e impresión: Fernández Ciudad, S.L.

Coto de Doñana, 10 - 28320 Pinto, Madrid

Depósito Legal: M-

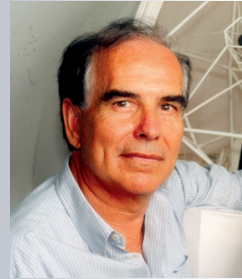
Impreso en España





Francisco Sánchez

Instituto de Astrofísica de Canarias



Preface

The inauguration of any state of the art telescope is always a matter of joy for the astronomy community. That is also the case for the Gran Telescopio Canarias (GTC), currently the World's largest IR-optical telescope. Such an inauguration is also a good place to meet colleagues, experts, friends, etc. So we asked the directors of the large telescopes currently in operation, as well as to the leaders of the future extremely large telescopes, that they join us for such an event. Then, we also thought, what a waste bringing together all these great minds, all these great people, for just a few hours. And here is the solution, a Workshop on the Future, when we just had finished inaugurating the "past". We thought it was important to grab the opportunity to think about the science to be done with the current facilities, to offer a space to ponder on strategies in preparation for the extremely large facilities of the future. The response to our invitation was great, and I can only be thankful to the many participants for your generosity both with your time and with your ideas.

We knew that the GTC, a 10.4m, segmented primary mirror telescope, was the last to join this exclusive club of large telescopes already in operation. We knew that Spain had never built even a medium size telescope of its own. For these and other reasons, the GTC, the most advanced telescope of its class, represents a great achievement by Spanish Astronomy, so you will understand that we feel very proud of it.

Indeed the GTC was designed to achieve excellent image quality, to be operationally efficient and very robust against failures. We have already seen the high image quality, the rest is still to be seen... Yes, we knew that the GTC was a late addition to the club, for this reason the GTC was also meant to pave the way for the future extremely large telescopes. Indeed, telescopes larger than about 8 m in diameter will always be built using segmented mirror technology. The GTC has refined the state of the art in segmented mirror production and in the optical control of the image quality of segmented telescopes.

One aspect was clearly undisputed during the meeting. The 8-10 m telescopes will be the most demanded and used tools by the astronomy community in the next 10-15 years. In fact many of the people participating in the Workshop will likely finish a successful career in astronomy using these telescopes. It was realised that the sheer number of 8-10 m telescopes, with their phenomenal suit of state of the art instrumentation, spread across both hemispheres, represents the most powerful astronomical facility ever available to the current community of astronomers. So indeed, for the time being, and for at least the next 15-20 years, the right approach is to exploit the current large telescopes to produce the best astronomy.

For two days we had thought provoking presentations, and lively discussions. For instance, the question as to whether the 8-10 m telescopes should devote their capacities to catering for their respective communities, or whether they should agree and complement each other in the offer of instrumentation, was extensively discussed. Some successful ongoing collaborations were presented as examples to be followed.

Inevitably however, the new facilities loom over the horizon. Larger and larger telescopes are now on the drawing table. New and imaginative solutions are being thought out with regards to the size of the telescopes in the making, with regards to the new instrumentation, to the operational aspects, etc. Then on top of it there is the James Web Space Telescope, the successor to the extremely successful Hubble Space Telescope. The strength of the new projects is high. The enthusiasm too! The TMT, GMT, E-ELT, the LSST, etc. are here to stay. Their leaders showed us the power of their projects and the smartness of their solutions to difficult technological problems. These facilities are meant to be the drivers of Astronomy in the 20's and beyond.

This book, I hope, captures the essence of what was said and discussed during the meeting and we are very grateful to each of the contributors for their manuscript. I also hope that the book is useful to the current and future users of the 8-10 telescopes so that they realise the huge potential of the facilities they have within their reach. I also hope the book prepares the path for the new generation of telescopes, and most of all, sets the mood for cooperation amongst the 8-10 m facilities, as well as between these and the new extremely large telescope projects now on the horizon.

Finally I should acknowledge and thank the sponsors of the meeting; the Fundación Ramón Areces, the Red de Infraestructuras de Astrofísica, the Grupo Santander (by means of the Encuentros Astrofísicos “Blas Cabrera”) and of course the hard work of Campbell Warden in organising the meeting and publishing these proceedings.

Francisco Sánchez
IAC Director



Science
with 8-10m
telescopes
in the era
of ELTs and
the JWST



William S. Smith, Jr.
Association of Universities for Research in Astronomy, 14



Bruno Leibundgut
European Southern Observatory, 32



Jerry Nelson
University of California at Santa Cruz, 52



Taft Armandroff
W. M. Keck Observatory, 64



Jean-René Roy
Gemini Observatory, 78



M. Iye
National Astronomical Observatory, Mitaka, Tokyo, 96



Thomas Henning
Max Planck Institute for Astronomy, 110



Phil Charles
Southern African Large Telescope (SALT) , 124



Alfonso Serrano
Instituto Nacional de Astrofísica, Óptica y Electrónica (INAOE) Mexico, 142



Anthony Tyson
University of California, Davis, 160



José Franco
Instituto de Astronomía, UNAM, 178



Matthew Greenhouse
JWST Science Working Group, 198



Alvaro Giménez
Science Policy Coordinator, ESA and Centro de Astrobiología (CSIC-INTA), 216



Pedro Álvarez
Gran Telescopio CANARIAS - GTC, 232



Artemio Herrero
Instituto de Astrofísica de Canarias - IAC, 244

Acronyms List, 254