
# Workshop summary and next steps

# Calar Alto Instrumentation Workshop Program

## IAA-Granada, 11-13 June 2008

### 10 June

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| **18:00-20:00** | Cocktail reception at IAA | |

### 11 June

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| **9:00-9:10** | Welcome | IAA Director |
| **9:10-9:40** | Calar Alto status and goal of the workshop | Joao Alves |
| **9:40-10:10** | The new Panoramic NIR camera for Calar Alto: PANIC | Josef Fried |
| **10:10-10:40** | A VO-compliant Archive for Calar Alto | Enrique Solano Márquez |
| **10:40-11:30** | *Coffee Break* | |
| **11:30-12:00** | Improving seeing statistics to increase image quality | Wolfgang Gaessler |
| **12:00-12:30** | The experience with LIRIS at the WHT | Jose Acosta Pulido |
| **12:30-13:00** | The prospects of Multi-Channel Spectroscopy | Andreas Kelz |
| **13:00-15:00** | *Lunch* | |
| **15:00-15:30** | Instrumentation plans at AAO | Matthew Colless |
| **15:30-16:00** | The GTC and its instrumentation Suite | Jose M. Rodriguez Espinosa |
| **16:00-16:30** | Future ESO Facilities | Mark Casali |
| **16:30-17:00** | Discussion on Synergies (*leaders T. Henning & J. Torra*) | |

### 12 June

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| **9:30-10:00** | Precise Stellar Radial Velocity Measurements | Artie Hatzes |
| **10:00-10:30** | A high resolution multi-object spectrograph for Calar Alto | Eike Guether |
| **10:30-11:00** | A high-resolution near-infrared spectrograph for CAHA 3.5m | Pedro J. Amado Gonzalez |
| **11:00-11:30** | *Coffee Break* | |
| **11:30-12:00** | Conceptual design for a high-time-res, multichannel-cam | Antonio de Ugarte Postigo |
| **12:00-12:30** | A NIR camera-spectrograph for the Calar Alto 3.5m | Alcione Mora |
| **12:30-15:00** | *Lunch* | |
| **15:00-15:30** | PMAS - past, present, and future | Martin Roth |
| **15:30-16:00** | Astrophotonics | Jeremy Allington-Smith |
| **16:00-16:30** | MSIX: A Super-Wide IFU for the CAHA 3.5m | Armando Gil de Paz |
| **16:30-17:00** | Discussion of 3D spectroscopy (*leaders I. Márquez & M Roth*) | |
| **19:00** | Workshop dinner | |

### 13 June

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|---|---|---|
| **9:30-10:00** | Multi-Object High-Resolution Spectrograph | Andreas Quirrenbach |
| **10:00-10:30** | XMS - Extreme Multiplex Spectrograph for CAHA 3.5m | Tom Shanks |
| **10:30-11:00** | *Coffee Break* | |
| **11:00-11:30** | 3DCA: a wide-field Fabry-Perot/Tuneable Filter for CAHA 3.5m | Dominik Bomans |
| **11:30-12:00** | Discussion and end of Workshop | |
| **19:00** | Flamenco show | |

# Background

There is a growing realization that 4m class telescopes have an important role to play in frontline Astrophysical research in the beginning of the 21st century. And, as always, outstanding scientific breakthroughs are associated with outstanding instrumentation. In an effort to put Calar Alto Observatory at the forefront of Astronomical research, attacking the pressing scientific challenges of the day from Extra-Solar Planets to Cosmology, Calar Alto organized an instrumentation workshop to gather outstanding ideas for the next generation instrument for its flagship telescope, the CAHA 3.5m.

The presentations and lively discussion of ideas on the next generation instrument took place in Granada, 11-13 June 2008, at the Instituto de Astrofísica de Andalucía (IAA-CSIC). The program of the workshop included presentations on:

- The current status of Calar Alto
- The current status of the new Panoramic Near-Infrared Camera for the 2.2m telescope, PANIC
- Similar efforts at other observatories
- Possible science niches
- Possible upgrades to existing instruments
- New instrumentation ideas
- Discussion sessions

The workshop counted with the presence of about 60 participants not only from the partner countries but from all across the world. In this summary we concentrate on the new instrumentation ideas and the foreseen steps towards converting at least one, or a merged set of, into a successful instrument at the recently upgraded 3.5m.

# New instrumentation ideas

Following the order of presentation at the workshop, we have:

## 1. A high-resolution multi-object spectrograph (E. Guenther, A. Quirrenbach).

- Main scientific driver: follow-up of extra-solar planets surveys (PLATO, Pan-STARRS, GAIA, etc.).
- A secondary scientific driver is high-resolution spectroscopy of large samples of stars in the Milkyway (chemistry, dynamics).
- The multiplex capability is needed, but not clear yet how much multiplex: go for PLATO (180 stars/sq deg) or go for low mass planets (with substantially less density per sq deg)?
- Surely in the visible, but NIR option is interesting but needs investigation.

## 2. A high resolution near-infrared spectrograph (P. Amado)

- Main idea: a common-user, high-resolution, near-infrared echelle spectrograph.
- Two main scientific drivers: extrasolar planets around very low mass stars and stellar seismology.

- High resolution (R ~ 80,000), wavelength coverage (0.95-1.8 μm; Y, J and H bands).
- Highest available precision to measure radial velocities (<10 m/s). RV = 2 m/s (1σ) for an M star of J=9 mag in 900s, enough to detect $M_{Earth}$ exoplanets around M stars. Complementarity with space-borne and ground-based optical and infrared instruments.

## 3. A high-time resolution multichannel camera (A. de Ugarte Postigo)

- A GRB machine: time resolution of the order of a second, multichannel.
- Secondary drivers: compact binaries (WD, NS, BH), microquasars, outburst in variables.
- Wavelength and spatial coverage: 8 simultaneous bands (u, g, r, i / y, J, H, K). FOV ~ 3-5 arcmin.
- High time resolution (~10 images/s). Narrow band filters. Low resolution spectroscopic mode.

## 4. An infrared multipurpose camera (imaging, spectroscopy, and polarimetry) (A. Mora)

- A multipurpose infrared camera attacking a wide range of scientific cases.
- Wavelength coverage: 0.95-2.50 μm (YJHK). Plate scale: 0.3"/pixel, Field of view: 10.2'x10.2'.
- Imaging: 1 hour, S/R = 5, Vega magnitudes: Y= 23.1, J= 22.6, H= 21.8, Ks= 21.2. Comparison with OMEGA-2000: Δmag ~1-1.5 deeper because of cold stop.
- Spectroscopy: 50 < R < 30000, Polarimetry: Wire grid, Double Wollaston

## 5. A super-wide IFU (A. Gil de Paz)

- Main scientific driver: Spectroscopic mapping of nearby galaxies.
- Secondary scientific drivers: nearby stellar clusters and cosmology
- 9-module IFU: 400 fibers/module. Diameter=2.5", filling factor=0.65, Field of View: 4'x4'.
- Two fixed grating sets: R=1700 (1.3 Å/pix to cover 3650-9000 Å) and R=8000 (0.4 Å/pix to cover 7650-9300 Å)

## 6. An extreme multiplex spectrograph (T. Shanks)

- Main science driver: cosmology.
- Four cloned spectrographs to cover 1deg$^2$ field. Gives ~4000 slits at default resolution R~400 (10Å) over 2000Å range (slits 1.5"x10").
- Can survey 250000 galaxy redshifts at z~0.7 in 10 nights (i.e., 2dFGRS in 5% of the observing time at 6x bigger z and ~4mag fainter).
- i<22 galaxy emission line z from OII 3727Å at S/N>6 in 1hr exposure in ~2´´ seeing; i<21 galaxy absorption line z at continuum S/N>4 in 1hr exposure in ~2´´ seeing; r<25 z~3 Lyman break galaxies in 4x3hr exposures in ~1´´ seeing

## 7. A Fabry-Perot/Tunable filter instrument (D. Bomans)

- Main science driver: ISM characterization in nearby galaxies and gas accretion and radiative feedback in the early universe
- Secondary science drivers: halo gas kinematics, galactic winds, gas accretion, galaxy groups, chemical evolution, circumstellar environments.
- Spectral resolution: LR 500-10000; HR 10000-40000
- Wavelength coverage: 370-900 nm

# Next steps

Calar Alto is currently under an external review (Oct 2008) that will provide the basis for the 2013+ negotiations. It is not expected that the current observatory mode of operation (short programs addressing all science cases) will remain in the future. Instead, a positive 2013+ decision will presumably require the development of competitive and unique instrumentation associated with large dedicated programs. Calar Alto will become less and less a multi-purpose observatory to focus on a much smaller number of science cases associated with an unique and competitive instrument, and showing potential for high scientific impact through a large telescope time allocation.

Calar Alto and its funding partners (CSIC and MPG) are then looking for competitive science cases and associated instruments concepts. As announced before the workshop, there will be a call for science cases and instruments in 2008, for which Calar Alto will fund up to two design studies. It is expected that the final instrument investment should be predominantly externally funded. Still, and for a return on the operating costs of the observatory, the close involvement of CSIC and MPG researchers is desirable. Pending a positive 2013+ decision (due in early 2009), the chosen project will be implemented.

Some interesting topics discussed at the workshop remain open, like the possibility to have visitor instruments in Calar Alto. These should be addressed in the 2013+ negotiations that will take place in early 2009.

# Acknowledgements

We thank all the participants for contributing to the lively meeting and in particular the discussion leaders for generating provocative and fruitful discussions. Special credit is due to SOC and LOC member Pepa Masegosa for the invaluable help in preparing the program as well as making the workshop logistics at IAA a breeze.

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João Alves
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