high-resolution continuum observations but also spectroscopically. Molecular abundances vary with evolutionary state, as different species appear and disappear, for example by depletion onto dust grains. A plethora of molecular species can be used as tracers of the complex physics and chemistry and the ability to model these processes with high spatial resolution was identified as an essential complement to ALMA observations.

Precision measurements of the spectral energy distributions of dust formation sites will give an indication of the grain size distribution in circumstellar discs. The evolution of dust can be followed as dusty particles around young stars collide and grow from sub-micron sizes to pebbles, boulders, planetesimals and eventually planets. The gaps predicted to occur in circumstellar discs as a result of planetary formation can be imaged directly by ALMA.

ALMA will enable a comparable series of advances in the field of galaxy formation and evolution, particularly at early epochs. Galaxy number counts will be extended to the faintest sources in every ALMA band. The spatial and redshift distribution of these sources, as well as their luminosity functions will become measurable, as ALMA will not be confusion limited in any of its bands. It will excel as a follow-up instrument for large-area surveys with bolometer arrays, both in resolving continuum emission and in measuring redshifts from molecular lines. Very deep, but narrow-field surveys will also be carried out with ALMA alone. CO will be the molecule of choice for redshift measurement except for the earliest galaxies ($z > 6$), for which singly ionised carbon may be more appropriate. The reason is that the energy output in this line is likely to be much higher than in the very high order CO transitions redshifted to ALMA frequencies. Continuum observations of the dust emission from the very first galaxies, as well as spectroscopy of their molecular and atomic lines, will allow us to probe the epoch of re-ionisation for the first time. The measurement of molecular absorption lines towards quasars will probe more tenuous regions along the line of sight as well as placing strong limits on the variation of fundamental physical constants, such the fine-structure constant $\alpha$.

The dynamics of mass assembly in galaxies at $z \approx 3$ is just beginning to be resolved using ground-based near-infrared observations. ALMA will extend this to fainter, more typical and obscured objects. Indeed one of its top-level science requirements is to be able to resolve a galaxy like the Milky Way at $z = 3$ in CO or C II. On larger physical scales, imaging of the Sunyaev-Zel'dovich effect will provide a unique probe of substructure in the intracluster medium. The detailed chemistry of star formation in nearby galaxies will be a major topic for ALMA, as will the relationship between active galactic nuclei and starbursts.

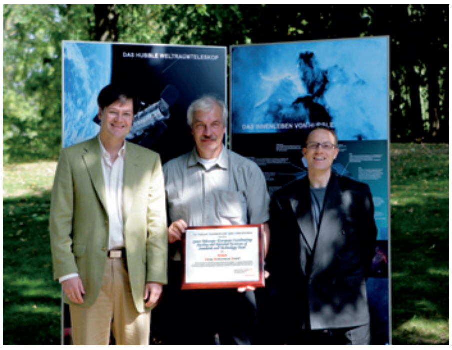
The meeting took place at the Consejo Superior de Investigaciones Científicas (CSIC) in Madrid and was financed by CSIC, Observatorio Astronómico Nacional, the ALMA project, ESO, NRAO, NAOJ, RadioNet and Astrocam. It was the second world-wide meeting on "Science with the Atacama Large Millimeter Array" (the first took place in Washington, D.C., in October 1999). The proceedings will be published in a special edition of Astrophysics and Space Science and the majority of presentations will be made available linked to *http://www.oan.es/alma2006*.

## Prestigious NASA Award for ST-ECF (ESO/ESA) Scientists

A team of scientists from the Space Telescope European Coordinating Facility (ST-ECF) and the United States National Institute of Standards and Technology (NIST) has received one of the most prestigious honours issued by NASA: a Public Service Group Achievement Award: "In recognition of painstaking efforts to provide maximum scientific value to HST data using precision laboratory spectral measurements and physical instrument modelling techniques."

In this transatlantic cooperation which earned this recognition, the European group (Michael Rosa, Florian Kerber and Paul Bristow; Figure 1) joined forces with their US colleagues (Joseph Reader, Gillian Nave, Craig Sansonetti; Figure 2) with the aim of improving the calibration of Hubble Space Telescope (HST) spectrographs.

In their effort the team combined advanced modelling techniques, to describe the physical properties of a scientific instrument, with high-quality laboratory measurements of the spectral lines emitted by a Pt/Cr-Ne hollow cathode lamp used as calibration source onboard HST. The measurements performed in the laboratory of the NIST Atomic Spectroscopy Group filled a significant gap in our understanding of the output of such lamps and added about 5000 lines as wavelength standards now usable for calibration purposes. These enhanced line lists were used as input for the instru-



The European part of the NASA award winning team, the group at ST-ECF: Florian Kerber, Michael Rosa, Paul Bristow (left to right).

ment models of two HST spectrographs, a technique that replaces empirical fitting routines with the knowledge of the physical properties of the instrument. A physical instrument model is based on the optical and mechanical design of the spectrograph but will also take into account environmental conditions such as temperature. Group Leader Michael Rosa said: "Calibration based on instrument models has been demonstrated to provide better accuracy than empirical methods but in addition it also provides a real understanding of the instrument which enables one to maintain it at maximum performance and quickly diagnose any deviations."

The NASA award specifically acknowledged that the instrument modelling approach and its success is not specific to any instrument but can be applied to a large variety of astronomical instruments. It is no surprise that instrument modelling, originally developed for ESO's high-resolution spectrograph UVES, and having been 'to space' is coming full circle. Two members of the team (Florian Kerber and Paul Bristow), now with ESO's Instrumentation Division, are applying the NASA award-winning methods – instrument modelling combined with state-of-the-art laboratory measurements in a collaboration with ST-ECF and NIST – to the calibration of the latest spectrographs for the VLT, the Cryogenic IR Echelle Spectrometer (CRIRES) (see page 32 of this issue) and X-shooter. With the development of extremely demanding future instruments for a European ELT, new challenges await.

The US part of the NASA award winning team, the group at NIST: Joseph Reader, Gillian Nave and Craig Sanonetti (left to right).

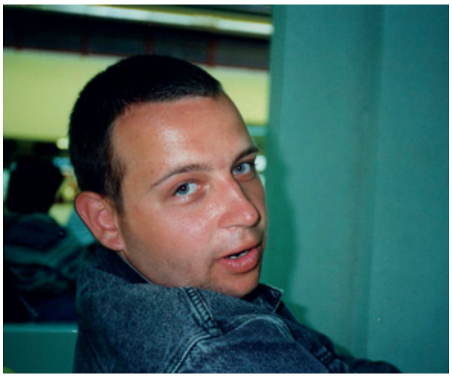
# Fellows at ESO

## Dominique Naef

I completed my PhD thesis in the Geneva extra-solar planets search group late 2003. During my PhD years, I participated in so many observing runs at the Swiss telescope at La Silla that making a post doc in Chile became quite an obvious choice. In spring 2004, I moved to ESO-Chile with a Swiss grant. During my first post doc year, I worked in the La Silla Science Operations team where I was mostly involved in the support of the HARPS spectrograph. Later in 2004, I applied successfully for an ESO fellowship.

I started this second post doc in spring 2005 at the Paranal Observatory. At Paranal, I mostly work with the UT2-Kueyen telescope and I am attached to the FLAMES support team. A large part of the fellows' duties consist in executing service-mode observations. I really enjoy it since it gives me the possibility to learn a lot about fields in astronomy that are very far from my favorite ones. Supporting visiting astronomers during their observing runs at Paranal is also a task I really appreciate because it gives me a unique opportunity to get direct feedback from ESO users. Moreover, very stimulating scientific discussions are not rare during these visitor runs.

My main scientific interests are the detection and characterisation of extra-solar planets and brown dwarfs. I am involved in several planet search programmes using various ESO and non-ESO facilities: HARPS at the 3.6-m telescope, CORALIE at the Swiss 1.2-m Telescope, FLAMES at VLT-UT2 or NACO at VLT-UT4. I also participate in programmes aiming at the characterisation of transiting exoplanets using ground-based facilities (e.g. FORS1 at VLT-UT2) and space-based telescopes (e.g. HST or XMM). The main goal of all these research activities is to understand how planets form around stars.



Dominique Naef