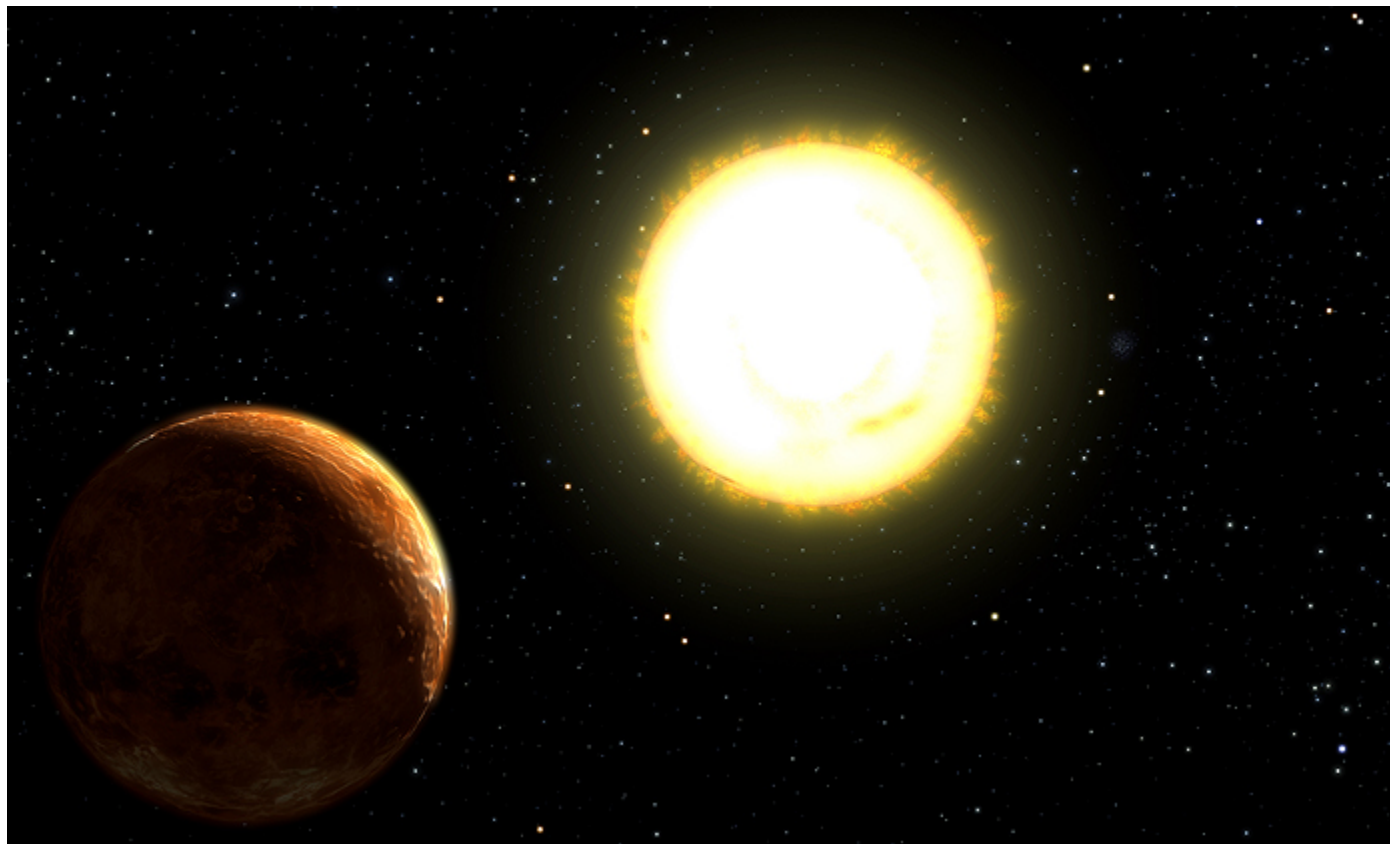




Fiber Echelle Spectrograph Finds New Life as Exoplanet Hunter

A. Tokovinin



Could a large rocky extrasolar planet like this one be orbiting Alpha Centauri?

Artist's concept: NASA

NOAO South users were left without any capability for high-resolution stellar spectroscopy upon the retirement of the Echelle Spectrograph from the Blanco 4-meter telescope in 2006. However, this old spectrograph has found a new life owing to a recent collaboration between NOAO and the California and Carnegie Planet Search team led by Debra Fischer (San Francisco State University [SFSU]) and Geoff Marcy (University of California, Berkeley).

Their idea is to obtain a large number of precise radial-velocity (RV) measurements of a selected target: our closest stellar neighbor, Alpha Centauri. The purpose of this "Mission to Alpha Cen" is to search for terrestrial planets around this solar-type star by reaching unprecedented RV accuracy (on the order of 10 centimeters per second) and dense time coverage. Availability of large blocks of telescope time is a key factor in this project.

The spectrograph was moved to the coudé room of the CTIO 1.5-meter telescope, and an entirely new fiber link was implemented. Stellar light is directed to the spectrograph from the guiding module, so echelle spectroscopy can be combined with other work (such as the R-C Spectrograph) without instrument changes. The spectrograph optics are maintained in a fixed configuration covering the range from

4020 to 7300 Ångströms, with no changes allowed. A two-pixel resolving power of $R=42,000$ is available at the expense of some light loss.

The system efficiency is about one percent, so to reach a signal-to-noise ratio of 100 per pixel ($S/N=100$ per pixel), a $V=7$ star must be exposed for 10 minutes. By opening the slit, we gain 1.5 in the efficiency at $R=20,000$. The scrambling properties of the fiber result in a very good stability, on the order of 0.01 pixel (36 meters per second [m/s]). An iodine cell brings the RV precision to ~ 1 m/s for single observation, with further precision gain expected by averaging hundreds of observations per night. In fact, up to 300 measurements per night were obtained during the first test run of the instrument (May 19 to June 15). See the manual and other materials at www.ctio.noao.edu/~atokovinin/echelle/.

The fiber-linked Echelle Spectrograph is now available to the SMARTS consortium and to general NOAO users. A data reduction pipeline for precise RV is under development at SFSU. We are investigating the possibility of replacing the old spectrograph with a new, more efficient design. The 2K SITe CCD with its Arcon controller also must be replaced in the longer term.

Progress on the SOAR Adaptive Module

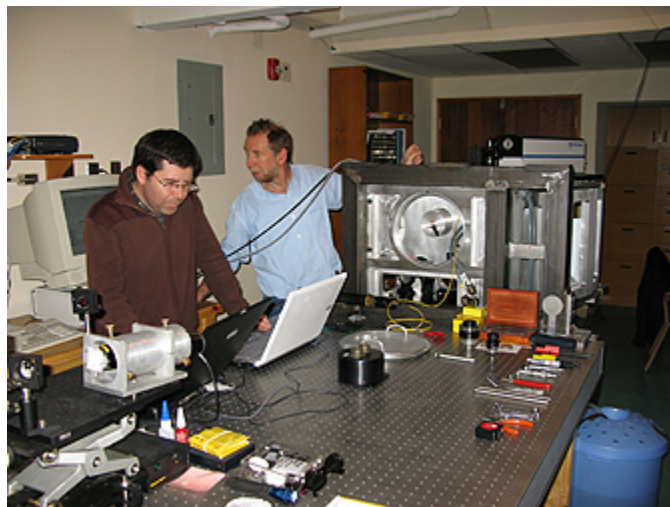
Brooke Gregory & Nicole S. van der Blik

The SOAR Adaptive Module (SAM) is coming together in the optics lab of NOAO South in La Serena. The photo shows optical engineer Roberto Tighe (right) and software engineer Rolando Cantarutti testing the real-time adaptive optics software, with all of the final opto-mechanical components placed in the SAM module.

Meanwhile, work proceeds in parallel on completion of control electronics, cabling of the module, design of the Laser Guide Star system (for the second phase), and design of the detector mount and Dewar for the SAM imager (SAMI).

The instrument is currently scheduled to be commissioned on the SOAR 4.1-meter telescope in Natural Guide Star mode in mid 2009. The laser system is scheduled for commissioning a year later.

For more pictures and updates on the integration of SAM, go to www.ctio.noao.edu/new/Telescopes/SOAR/Instruments/SAM/.



Students Wanted for REU at CTIO

Cerro Tololo Inter-American Observatory (CTIO) offers six undergraduate research assistantships during the northern winter semester 2008-2009 through the NSF-funded Research Experiences for Undergraduates (REU) program. The CTIO REU program provides an exceptional opportunity for undergraduates considering a career in science to engage in substantive research activities with scientists working at the forefront of contemporary astrophysics. Student participants will work on specific research projects in areas such as galaxy clusters, gravitational lensing, supernovae, planetary nebulae, stellar populations, star formation, variable stars and the interstellar medium, in close collaboration with members of the CTIO scientific and technical staff. Furthermore, the program emphasizes observational techniques and provides opportunities for direct observational experience using our state-of-the-art telescopes and instrumentation.

Participants must be enrolled as full-time undergraduate students during the REU program, and must be citizens or permanent residents of the United States. The program will run for 10 weeks, from approximately January 12 to March 22. Complete applications, including applicant information, official transcripts and two or three letters of recommendation should be submitted no later than 5 October 2008. For more information (and the application), please see www.ctio.noao.edu/REU/reu.html. Women and minorities are strongly encouraged to apply.

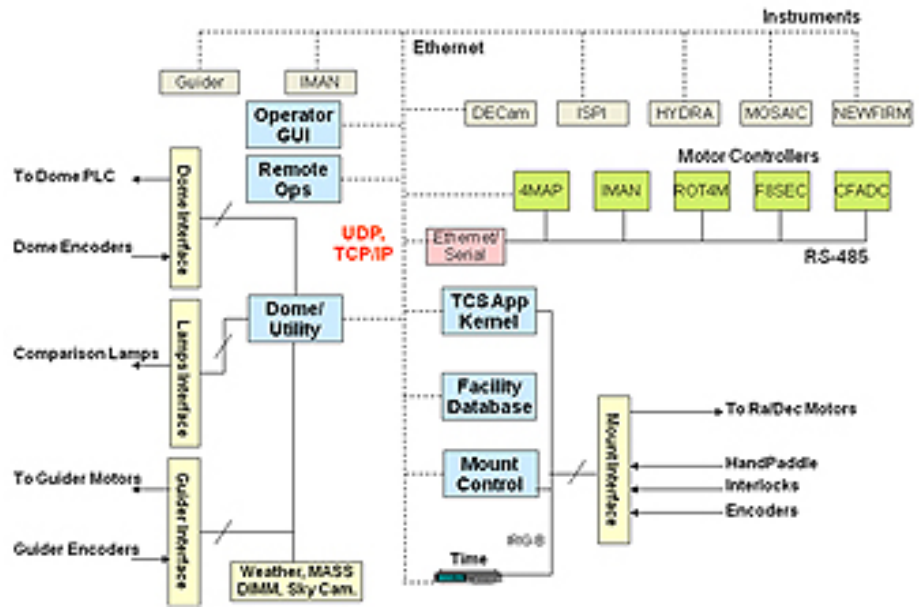
— Ryan Campbell

Blanco TCS Upgrade

Timothy Abbott

As part of the normal cycle of upgrades, and with a view toward proper support of the NOAO Extremely Wide-Field Infrared Imager (NEWFIRM) and the Dark Energy Camera, CTIO staff are currently engaged in upgrading the telescope control system (TCS) of the Blanco 4-meter telescope. The team working on the Blanco project is the same one that produced the SOAR TCS and that is developing the Large Synoptic Survey Telescope TCS. All three telescopes are expected to profit from synergies among the three systems and we are seeking to make them overlap as much as possible.

The Blanco upgrade will see the replacement of all TCS components outside of the driver motors and drive trains, from encoders to power drivers. Wherever possible, we will use off-the-shelf components with an anticipated market lifetime of at least five years. Tape encoders will be used on both axes, and programmable power drivers have been purchased to improve motor control. The modularized and distributed computer system is comprised of Linux boxes communicating via Ethernet. State-of-the-art software control will allow us to optimize telescope accelerations and slew trajectories, particularly to avoid exciting telescope resonances. Slew speed must be fast enough to not provide the



limit for the Dark Energy Survey cadence, which has a field separation of two degrees and readout time of 17 seconds.

Telescope and environment telemetry capabilities will be enhanced and recorded in a database to be useful for all instruments. Modern human/machine interfaces will be provided. The upgrade is specified to proceed

without interrupting normal telescope operations and is expected to be fully functional by January 2010.

The project was summarized in a paper presented at the recent Marseille SPIE conference (T. Abbott et al., 2008, Proc. SPIE 7012, in press). The figure illustrates the upgraded control architecture.

Chile Staff Changes

Alistair Walker

Verne Smith, director of the NOAO Gemini Science Center (NGSC), and Katia Cunha, NOAO astronomer, moved back to NOAO Tucson in August after almost 18 months in La Serena. Verne and Katia will both continue their involvement with NGSC, so we expect to be able to welcome them back as visitors often in the future—a small consolation for losing two great colleagues and one-eighth of our scientific staff.

Jayadev Rajagopal transitions from Research Associate to Assistant Scientist on October 1. Jayadev has held his present position since

June 2006, where his service roles have consisted of support of infrared (IR) instrumentation at Gemini through NGSC, and work on interferometry development with Steve Ridgway. Jayadev will continue some involvement on these topics at a lower level than at present, with his major service role moving to scientific support for IR instrumentation on the CTIO telescopes, where we are sure his instrumental and observing skills will greatly strengthen our efforts in this area. Over the next 18 months, we are expecting NEWFIRM on the Blanco and the Spartan IR Camera at SOAR, and Jayadev can expect to be very involved with helping

to bring these instruments into full and effective operation.

In September, we welcome Ryan Campbell as our new Research Experiences for Undergraduates (REU) site director. Ryan will start only a few months before our 2009 REU students arrive for their (southern) summer sojourn. Ryan just completed his PhD at New Mexico State University, working on magnetic cataclysmic variables (polars). He is our third recent REU director to be interested in cataclysmic variables, and we are beginning to think that this specialty must be an essential qualification for the job!