LIGHT BUCKET ASTRONOMY CONFERENCE

Technology Developments and Research Programs

Canada-France-Hawaii Telescope Headquarters, Waimea, Big Island of Hawaii
31 December 2010 - 2 January 2011

Co-Chairs
Russ Genet (Calif. Polytechnic State Univ.), and Bruce Holenstein (Gravic, Inc.)
Local Hosts
Josh Walawender (Univ. of Hawaii Institute for Astronomy), and Sarah Gajardhar (CFHT)
Conference Webmaster
Cheryl Genet

Mauna Loa / **Mauna Kea** pre-conference tours 29/30 December
Volcanoes National Park post-conference tour - 3 January

Click here for conference website

Conference Goals

The goals of the conference are two fold. First, to explore how new technologies can be applied to developing lightweight, low cost, meter class "light bucket" telescopes and their instrumentation. Second, to describe the scientific research programs that would most benefit from telescopes which are so low in initial and operational cost that entire telescopes or even arrays of telescopes can be dedicated to specific research programs.

What is light bucket astronomy?

Jacquelyn Mitton, in the *Cambridge Dictionary of Astronomy* (2001), defines a *light bucket* as **"**A colloquial expression for a *flux collector."* She defines a flux *collector*, in turn, as **"**A telescope designed solely to collect radiation in order to measure its intensity or to carry out spectral analysis," mentioning that, "No attempt is made to form an image so a flux collector can have a more crudely figured reflective surface than a conventional telescope." We have extended Mitton's light bucket definition to include photometric CCD "imaging" with low quality, low cost optics (typically one wave or less as opposed to quarter wave or better optics).

Light bucket telescopes excel in comparison with smaller aperture, more expensive, diffraction-limited telescopes when the sky background is a small or nearly negligible source of noise. This situation can occur when: (1) the object being observed is very bright, (2) the integration times are very short and hence photon arrival noise becomes important, (3) scintillation noise becomes a dominant noise source, (4) the bandwidth is very narrow or the light is spread out as in spectroscopy resulting in significant photon arrival noise, or (5) noise from the detector is dominant, as it can be in the near infrared.

Science programs well suited for light bucket astronomy include: many high speed phenomena, including lunar and asteroid occultations; fast cadence, high precision CCD photometry; near infrared diaphragm-limiting or area photometry; low to medium resolution spectroscopy; and polarimetry. Finally, we note that an array of a half-dozen light bucket telescopes equipped with very high speed photometers could, with their many two-telescope combinations, provide images of the surfaces of nearby stars via intensity interferometry—a quantum-mechanical effect that occurs at sub-nanosecond timescales. Such an array would be a modern extension of Hanbury Brown's pioneering research, decades ago, with his two-telescope interferometer in Narrabri, Australia.

Special thanks to Bruce Holenstein's friends
Jonathan and Nancy Sechrist at Makahiki Farms
for sponsoring the special
"Dark Night Observing" roast Kona coffee
for the conference

Conference Talks

»» Talk slide pdfs and audio-visuals ««
are linked beside the speakers below

Special Talk
Kepler: Are There Any Good Worlds Out There? Jon Jenkens **Talk slides** **Music**

Light Bucket Astronomy
Light Bucket Astronomy, Russ Genet and Bruce Holenstein **Talk slides**
Visions for Large Light Buckets, Russ Genet and Bruce Holenstein **Talk slides**
Signal-to-Noise of Program Object Measures, Bruce Holenstein **Talk slides**

Innovation
Innovation and the American Amateur Spirit, Jack Hitt **Talks slides**
The Other Side of Innovation, Chris Trimble **Talk slides**

Meter Class Portable Telescopes
Portable Computerized 1 Meter Telescope, Russ Genet, and Reed and Chris Estrada **Talk slides**
Meniscus Mirror Portable Telescope, Olivier Guyon
Portable 1 Meter Telescope, Mike Connelley

Kilns and Slumping
Low Cost Kilns, David Davis and Andrew Aurigema **Talk slides**
A Kiln for Slumping Mirrors, Olivier Guyon.

Foam Glass Composite Mirrors
Foam Glass Composite Mirrors, Andrew Aurigema **Talk slides** **Video links**
Lightweight Mirror Experiments, David Davis **Talk slides** **Video links**
Tessellated Foam Glass Mirrors, David Davis **Talk slides**

Mirror Coating Technologies
Deposition Silvering, Sagar Venkateswaran **Talk slides**
Silvering and Overcoating Experiments, Bruce Holenstein, Sagar Venkateswaran, Mike Holenstein, and Dylan Holenstein **Talk slides**
Introduction to Sol-Gel Processes, Lisa Brodhacker **Talk slides**

Passive and Active Primary Mirror Support Systems
Low Cost Air Bag Mirror Support System, Steve Taylor **Talk slides**
Active Primary Mirror Support Experiment, Mike Connelley **Talk slides**
Low Cost Fixed and Bimorph Correctors, Bruce Holenstein **Talk slides**

Telescope and Observatory Control Systems
Sidereal Technology Control System Developments, Dan Gray **Talk slides** **Movie**
Dedicated Systems: Small Telescopes in the Era of Big Science, Josh Walawender **Talk slides**
The Case for Automated Telescopes, Josh Walawender **Talk slides**

Near Infrared Aperture Photometry
Progress Report on a J/H(Ks) Aperture Photometer, Greg Jones **Talk slides**
Telescope Design Considerations for Near Infrared Photometry, Mike Connelley **Talk slides**

High Time Resolution Photometry
Experiments with High Speed Cameras, Bruce Holenstein **Talk slides**
A High Speed Electrometer for Photodiode Photometers, Bruce Holenstein **Talk slides**
Methods for Time Stamping Analog and Digital Video, Frank Suits **Talk slides**
Occultation Timing Accuracy: Dependence on Frame Rate and S/N, Frank Suits **Talk slides**

Occultation Photometry
Missions for Portable Meter Class Telescopes, David Dunham **Talk slides**
Lunar Occultation Theory and Practice, Bruce Holenstein **Talk slides**
Observing Trans-Neptunian Objects with Portable Telescopes, Marc Buie **Talk slides**
Portable Occultation Telescope Requirements, EliotYoung **Talk slides**
Portable Occultation Systems for Studies of Pluto and Triton, Leslie Young and Cathy Olkin **Talk slides** **Webslides**