OBSERVING REQUEST
University of Arizona Observatories

Year: 2015 **Term:** Jan–Jul **Proposal type:** education/outreach

Astronomy Camps 2015

P.I.: Don McCarthy (SO; *dmccarthy@as.arizona.edu*; 621-4079)

CoI(s): V. Bailey⋆ (SO), K. Follette⋆ (SO), E. Hooper (UWisc), W. Schlingman (UC-B), C. Kulesa (SO), P. Sheehan⋆ (SO)

Abstract of Scientific Justification

Astronomy Camp proposes to continue its programs for education and public outreach (E/PO) throughout 2015 (A and B) for its 28th year of operation. Astronomy Camp provides authentic, immersion experiences under the theme of "research-based science education" and engages international participants (teens, adults, educators, schools) in the process of scientific inquiry and discovery. The primary emphasis engages teenagers in three weeklong, residential events on Kitt Peak during June . Those efforts involve the 90" telescope, especially during the Advanced Camp which uses the B&C Spectrograph for research such as rapid supernova classification, followup of WISE bright-cluster galaxy targets, and Camper-initiated projects. On Mt. Lemmon and Bigelow we also host two weekend events for adults and two "Train the Trainer" workshops for adult leaders of the Girl Scouts of the USA as part of NIRCam's E/PO program for JWST. Astronomy Camps are well known internationally and bring widespread credit to the University as well as talented undergraduate and graduate students plus educationally-minded postodcs and new faculty. Spinoffs from this program include NIRCam's E/PO program, the Mt. Lemmon SkyCenter, the introduction of Quantitative Literacy into formal teaching, facility improvements to buildings on Mt. Lemmon, fund raising for the Catalina Sky Survey, and a host of activities and demonstrations for use in our General Education classes. We propose specific dates in 2015 using both PI, and facility, cameras and spectrometers. A long-term allocation is essential for advertising and for recruitment of both students and staff.

Summary of observing runs requested for this project

Run	Telescope	Cage	Instrument	PI	AO	Nights	Moon	Scheduling Optimal	Scheduling Acceptable	Sharing Poss.	Sharing Adv.
1	90"	f/9	B&C			10	3B3G4D	June	June	yes	yes
2	61"	f/13.5	CampEquip			7	1B2G4D	Apr/Oct	Apr/Oct	no	no
3	20"Jamieson	f/16	Camp			7	1B2G4D	Apr/Oct	Apr/Oct	no	no

Scheduling constraints and unusable dates *(up to 4 lines)*: see specific dates listed Scientific Justification. We wish to share time with Betsy Green's spectroscopy proposal

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A ⋆ appended to the proposal type indicates a continuation proposal; a ⋆ appended to the name of a proposer indicates the proposer is a (graduate) student; a proposer whose name is underlined is certified on the proposed telescope/instrument combination; if a ∗ appears within the PI or AO box in the observations summary table, the instrument is a PI instrument and/or Adaptive Optics are requested – signatures are required on the next page.

Target list (attach list if longer than 26 objects)

#	Object	RA	Dec	mag / color / type / redshift / comment / etc.
1	*(Identify at least 1 object)*			

Approval for Instrument Use from PI: _____

*(have instrument PI signature appear on, or attach PI e-mail to, **all** copies)*

Graduate students *(provide the following information for **each** student named as PI or CoI on the cover page. Have the advisor's signature(s) appear on **all** submitted copies)*

Student's Name	Advisor's Name	Advisor's Signature	2nd-yr	Thesis

Scientific Justification

We plan to continue our 28-year international program of science education and public outreach using the astronomical facilities and professional scientists and engineers available primarily in the Tucson area. The Astronomy Camps use the excitement and diversity of astronomy to teach different aspects of mathematics, science, and engineering. We emphasize hands-on research using modern telescopes/instruments as well as role-modeling using Steward graduate and undergraduate students together with interested professional astronomers, physicists, engineers, and space artists from around the country. Astronomy Camps for national Girl Scout leaders comprise the primary outreach component for the NIRCam/JWST and have already had a major international impact on the astronomy curriculum for girls and women of all ages.

A typical Astronomy Camp enables students to undertake not only specific key projects developed by the staff but also their own proposed team projects which are then considered by an internal TAC and scheduled for specific times during the week. In the weeks and months ahead of Camp, students interact online with each other and with our professional staff to formulate research ideas such as lightcurves of variable stars, asteroids, and KBO's; transiting extrasolar planets; spectra of planetary surfaces and comets; stellar evolution; galaxy colors and morphology, etc. Last year's Campers were the first to classify four new supernovae, leading to six Astronomical Telegrams with all 30 names included. In addition to the facility Mont4kCCD, Camp also operates a CCD spectrometer, amateur CCD cameras, an optical photometer, and video equipment. Each year some students are successful in Science Fair entries. For example, in 2013, Ms. Katherine Cordwell reached the finals of the Intel Science Talent Search and the International Science and Engineering Fair, meeting President Obama in the process. In 2009, Mr. Harry Gaebler became the eighth Camper to win the National Young Astronomy Award with his Camp research entitled "A Study of the Correlation between Spiral Galaxy Distance and Morphology Using both Redshift and Extended Object Photometry."

Astronomy Camps have a remarkable and widespread popularity. To date, over 2500 adults, teens, educators, and students from special school groups have attended, representing 49 U.S. states and 20 foreign countries. Typically, at least 90 percent live outside Arizona, with some students traveling from as far away as Nepal. The Camps are listed in the summer opportunities guides for Gifted and Talented Associations in North Carolina and Texas and attract external scholarship monies from the Dudley Observatory, etc. Over the years 12 former Campers have received their astronomy PhD's; for example, [Casey (Cambridge), Roe (Lowell), Simcoe (MIT), Levine (Mt. Holyoke), Moustakas (NYU), Oppenheimer (Leiden), Kelly (Stanford)]. Also, 12 other alumni are currently seeking their PhD's in astronomy.

The Camps are financially self-supporting and have never received funding from the UA/Steward. In fact, the Camps are a source of income to UA/Steward since we routinely provide salary support for undergraduate and graduate students plus postdocs and also provide upgrades to telescopes, instruments, and associated facilities. Funding of the entire Mt. Lemmon site is now supported at the 30% level by three donors associated with Astronomy Camp. A former Astronomy Camper who has also upgraded old dormitories and built the associated SkyCenter.

The Camps are a major part of the education and public outreach program with NASA for our NIRCam contract for the James Webb Space Telescope. Since 2003, we have used this program to conduct "Train the Trainer" workshops for adult leaders from the Girl Scouts of the USA from nearly all US states and a few foreign countries. We now have an education network of 185 leaders who are using our astronomy materials and activities to promote STEM (science, technology, engineering, math) education for many thousands of girls and young women. Once JWST has launched successfully, these people will help disseminate the scientific results and will use those results to promote basic STEM literacy in both formal and informal education venues.

Astronomy Camp has also become a vehicle for faculty, graduate students, and postdocs to propose ed-

ucation components of their research proposals to the NSF and NASA. Examples include Laird Close's CAREER grant, two postdocs who applied to work at Steward in 2011, Wayne Schlingman's work at UC-Boulder, and Kate Follette's proposals for doing undergraduate research at other institutions.

The Camps annually receive about $10,000 in scholarship donations from former adult Campers, local businessmen and Astronomy Clubs, NIRCam and JWST's education program, the NASA Space Grant, the Dudley Observatory, NOAO, and the Franklin Roach memorial fund. Dr. Roach was a Steward faculty member. We are currently pursuing an emphasis on the Tohono O'odham Nation for the Teen Camps as well as followup activities during the school year to reinforce the educational value of the summer Camp.

LONG-TERM TIME REQUEST:

Inclusive Camp dates for 2015 are as follows with specific observing requests listed below:
GSUSA: April 24-26, Oct 9-11
Adult: May 15-18; Oct. 16-18
Teen: June 3-9 (Beginning); June 11-15 (TEC Mexican School); June 18-26 (Advanced)

We request the following specific nights on the 90", 61", and 20" Jamieson telescopes:

2015A
NIRCam E/PO Camp for GSUSA Leaders:
April 26 with Camp equipment on the 61-inch telescope (1B).

Beginning and Advanced Adult Camp:
May 15 thru 17 with Camp equipment and the Mont4k CCD on the 61-inch telescope (3D).

Beginning Teen Camp:
June 7 with Camp equipment, or the B&C Spectrometer, on the 90" telescope (1B).

Mexican Tecnologico de Monterrey school Camp:
June 13 with Camp equipment, or B&C Spectrometer, on the 90" telescope (1D).

Advanced Teen Camp:
June 18 thru 25 with the B&C Spectrometer on the 90" telescope, shared with Dr. Betsy Green (2B,3G,3D).

2015B
NIRCam E/PO Camp for GSUSA Leaders:
Oct. 11 with Camp equipment on the 61-inch telescope (1D).

Beginning Adult Camp:
Oct. 16 thru 17 with Camp equipment on the 61-inch telescope (2G).

Experimental Design & Technical Description *Describe your overall observational program. How will these observations contribute toward the accomplishment of the goals outlined in the science justification? If you've requested long-term status, justify why this is necessary for successful completion of the science.* ***(up to one page)***

A long-term allocation is essential for advertising and recruitment of both students and staff.

During the Advanced Teen Camp we wish to share observing time with Betsy Green's subdwarf proposal. Doing so provides our students an additional research project and mentoring from a skilled observer.

Summary of Time Requested and Awarded *The TAC needs to understand the scope of this project — (1) tell us how many UAO nights you've already had for this project, how many you request this time, and (a good guess of) how many you need to complete the project; (2) if a substantial amount of observing for this project comes from non-UAO telescopes, tell us about that observing, and how the UAO part fits in; (3) if you are collaborating with people who have telescopes, especially if you are part of a large collaboration, tell us who is leading the project, and how UAO time and your participation fit in.* ***(up to one page)***

Previous Use of Steward Facilities *List **all** allocations of telescope time for the present project and allocations for other projects on facilities available through UAO during the past 2 years, together with the current status of the data (cite publications where appropriate). Mark those allocations related to the present proposal (i.e, precede text with* `\related` *command). (**up to one page**)*

"Spectroscopic observations of PSN J12355235+2755563: Another likely LBV outburst", July 9, 2014, The Astronomer's Telegram, ATel #6303

"Spectroscopic classification of CSS140620:171007+610911 and correction of ATel 6523", June 24, 2014, The Astronomer's Telegram, ATel #6264

"Spectroscopic classification of CSS140620:171007+610911", June 24, 2014, The Astronomer's Telegram, ATel #6263

"Spectroscopic classification of SN 2014bv as SN Ia at the Advanced Teen Camp, June 21, 2014, "Supernova 2014bv in NGC4386 = PSNJ12243098+7532086", Electronic Telegram No. 3911, Central Bureau for Astronomical Telegrams, International Astronomical Union

"Spectroscopic classification of SN 2014bu as SN IIP at the Advanced Teen Camp, June 21, 2014, "Supernova 2014bu in NGC 694 = PSN J01505845+2159598", Electronic Telegram No. 3910, Central Bureau for Astronomical Telegrams, International Astronomical Union

"Spectroscopic classifications of ASASSN-14co and PSN J01505845+2159598", June 20, 2014, The Astronomer's Telegram, ATel #6255
"Spectroscopy of PSN J00513484+2943149 in UGC 525", June 28, 2013, The Astronomer's Telegram, ATel #5176

"Spectroscopic classification of SN 2013dq as SN Ia at the Advanced Teen Camp, June 28, 2013, "Supernova 2013dq IN UGC 525 = PSN J00513484+2943149", Electronic Telegram No. 3573, Central Bureau for Astronomical Telegrams, International Astronomical Union

"Spectroscopic classification of SN 2013do as SN IIp at the Advanced Teen Camp, June 26, 2013, "Supernova 2013do IN UGC 12137 = PSN J22395067+3812443", Electronic Telegram No. 3571, Central Bureau for Astronomical Telegrams, International Astronomical Union

Buckley, E., 2014. "Discovering the Universe at Astronomy Camp", Mercury, vol. 43, 1, pp. 28-34.

Sweet, W., 2012, "Sky Guy." Tucson Lifestyle magazine, Sept. 2012, vol. 31, #9, p. 15-16.

"2012 Education Prize" of the American Astronomical Society: UANews; AZ Daily Wildcat; AZ Daily Star; ASP

McCarthy, D. Podcast (October 17, 2011) concerning Astronomy Camp's 25th anniversary. Also available at iTunesU by subscribing to Steward Observatory's Public Evening lecture series.

McCarthy, D. "Lighting the Fire," Mercury magazine, 41, #2, pp. 16-21.

McCarthy, D. "Astronomy Camps XXIV," NOAO Newsletter, #104 (September 2011), pp. 38-39.

Spectroscopic classification of SN 2011dw as SN II/IIb at the Advanced Teen Camp, June 30, 2011, "Supernova 2011dw in PGC 58436 = PSN J16313945+4129229", Electronic Telegram No. 2755, Central Bureau for Astronomical Telegrams, International Astronomical Union

Spectroscopic classification of SN 2011dv as SN Ia at the Advanced Teen Camp, June 30, 2011, "Supernova 2011dv in NGC 6078 = PSN J16120400+1412330", Electronic Telegram No. 2755, Central Bureau for Astronomical Telegrams, International Astronomical Union

Spectroscopic classification of SN 2011dn as SN Ia at the Advanced Teen Camp, June 23, 2011, "Supernova 2011dn in UGC 11501 = PSN J19583553+0236163", Electronic Telegram No. 2746, Central Bureau for Astronomical Telegrams, International Astronomical Union

McCarthy, D. and Levy, D. H., 2010, "A Famous Telescope Turns 40." Astronomy, July 2010, vol. 38, #7, pp. 52-53.

MPEC 2010-K10: 2010 KC; Discovery of a Near-Earth Object NEO asteroid 2010 KC at the Advanced Adult Astronomy Camp, May 14-18, 2010. The 60" Prime Focus Camera was used to discover this object.

MPEC 2010-K08: 2010 JH110; Discovery of a Near-Earth Object NEO asteroid 2010 JH110 at the Advanced Adult Astronomy Camp, May 14-18, 2010. The 60" Prime Focus Camera was used to discover this object.

Fields, D. A. 2009, "What do Students Gain from a Week at Science Camp? Youth Perceptions and the Design of an Immersive Research-oriented Astronomy Camp." International Journal of Science Education, 31(2), 151-171.

McCarthy, D., "Advanced Astronomy Camp at the WIYN 0.9-meter,", WIYN Observatory Newsletter, (October 2009), pp. 1-2.

Koch, Ingrid, 2008, "Observation, Speed, and Light Curve Estimation of the Asteroid 5992 Nittler, American Astronomical Society, DPS meeting #40, #28.17; results from the 2008 Advanced Astronomy Camp.

Cheran, G. 2008, "A Week at Astronomy Camp," The Reflector: Quarterly Magazine of the Astronomical League, December 2008, pp. 12-15.