

# Imaging Under the Dark Skies at Deep Springs College

Presentation to BRDSC  
November 15, 2022

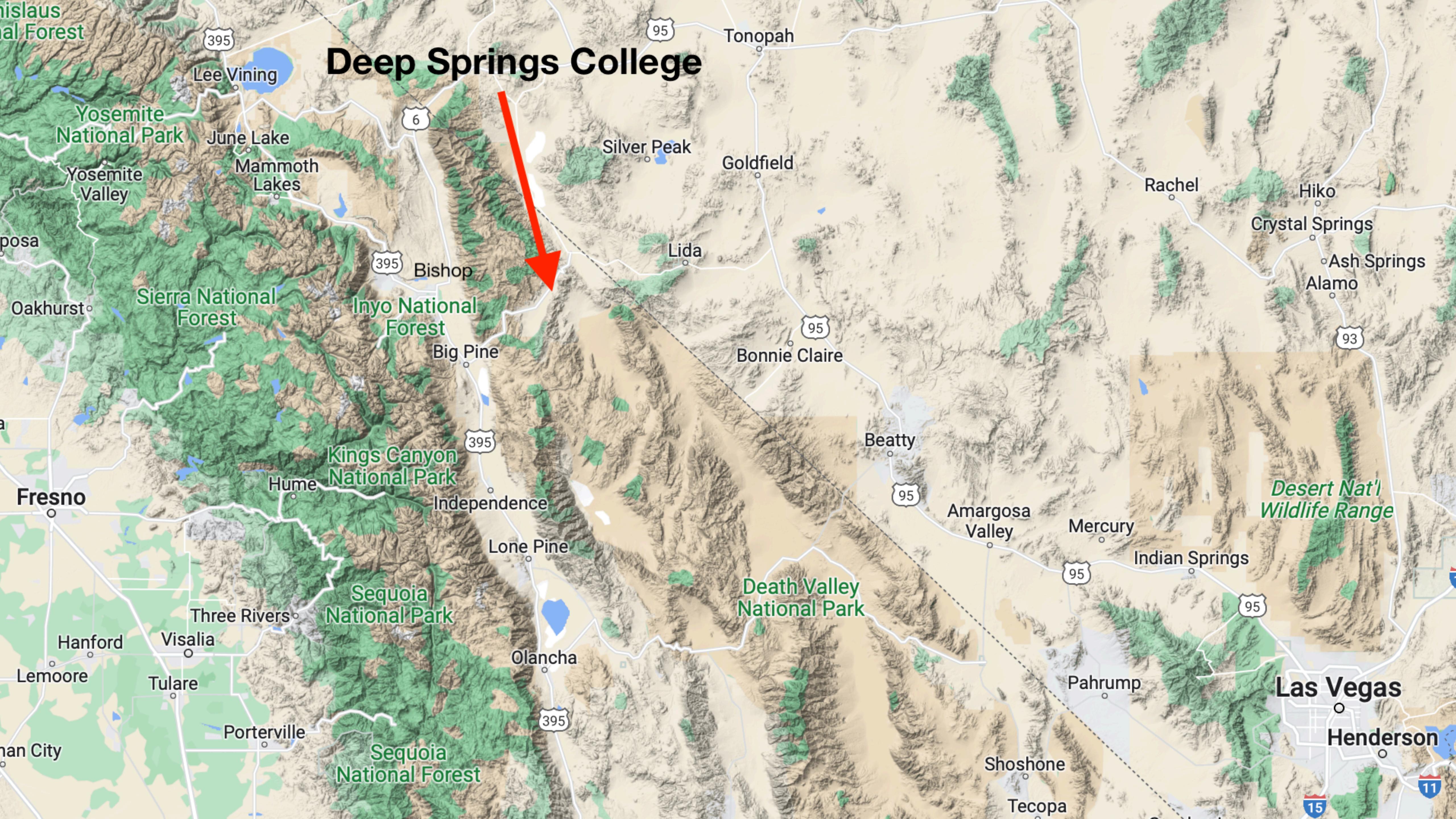
Brian Hill, Herb Reich Chair of Natural Science

# Outline

1. Deep Springs College
2. Siting the Observatory
3. Funding and Construction
4. Teaching and Research Objectives



# Deep Springs College



# Deep Springs College

- Founded 1917 by L.L. Nunn
- Two-year college accredited by ACCJC
- 12-14 students admitted each year — ~25 total!
- Full scholarship for every student admitted
- The Three Pillars:
  1. Academics
  2. Labor
  3. Self-Government

# Academics at Deep Springs College

- President Sue Darlington (Anthropology) — Sept. 1, 2020
- Dean Ryan Derby-Talbot (Mathematics) — July 1, 2021
- Three Long-Term Faculty
  - Antón Barba-Kay (Philosophy) — July 1, 2022
  - Anna Feuer (Political Science) — July 1, 2020
  - Brian Hill (Physics & Astronomy) — July 1, 2020
- Several visiting faculty each year round out the disciplines
- Long-term faculty capped at a maximum of 6 years
- Enduring yet constantly in flux

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# Siting Criteria

- Excellent Horizon
- Hidden
- Away from Campus Light
- On Deep Springs Property

Google Earth view, looking southeast



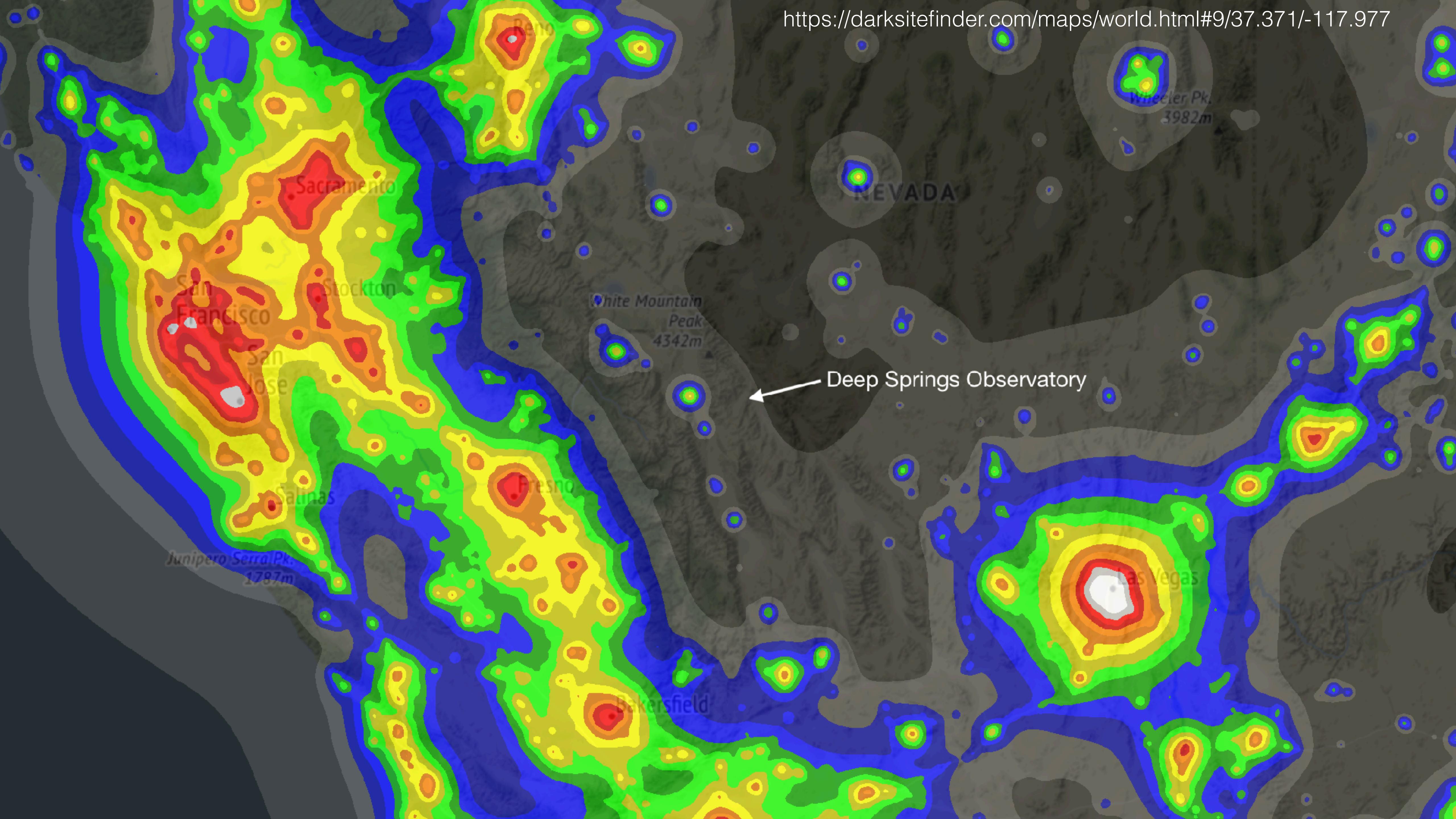
<https://www.lightpollutionmap.info>

**Zenith sky brightness info (2015)**

Coordinates	37.37100, -117.97700
SQM	22.00 mag./arc sec <sup>2</sup>
Brightness	0.172 mcd/m <sup>2</sup>
Artif. bright.	0.650 $\mu$ cd/m <sup>2</sup>
Ratio	0.0038
Bortle	<a href="#">class 1</a>
Elevation	1681 meters

Deep Springs Observatory

Our site's classification in (2015) was  
Bortle 1 (better than 21.99 mag/arcsec<sup>2</sup>)  
per <https://www.lightpollutionmap.info>





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# Funding and Construction

- Site selected, work begins, July 2020
- Dome and control room funded by Deep Springs Class of '77, December 2020
- Observatory put into service for spring course while still being completed, March and April 2022
- Observatory complete, science begins, October 2022
- Dedication & Class of '77 reunion, April 2023?

Oct., 2020



Mar., 2021



Apr., 2021



May, 2021



June, 2021





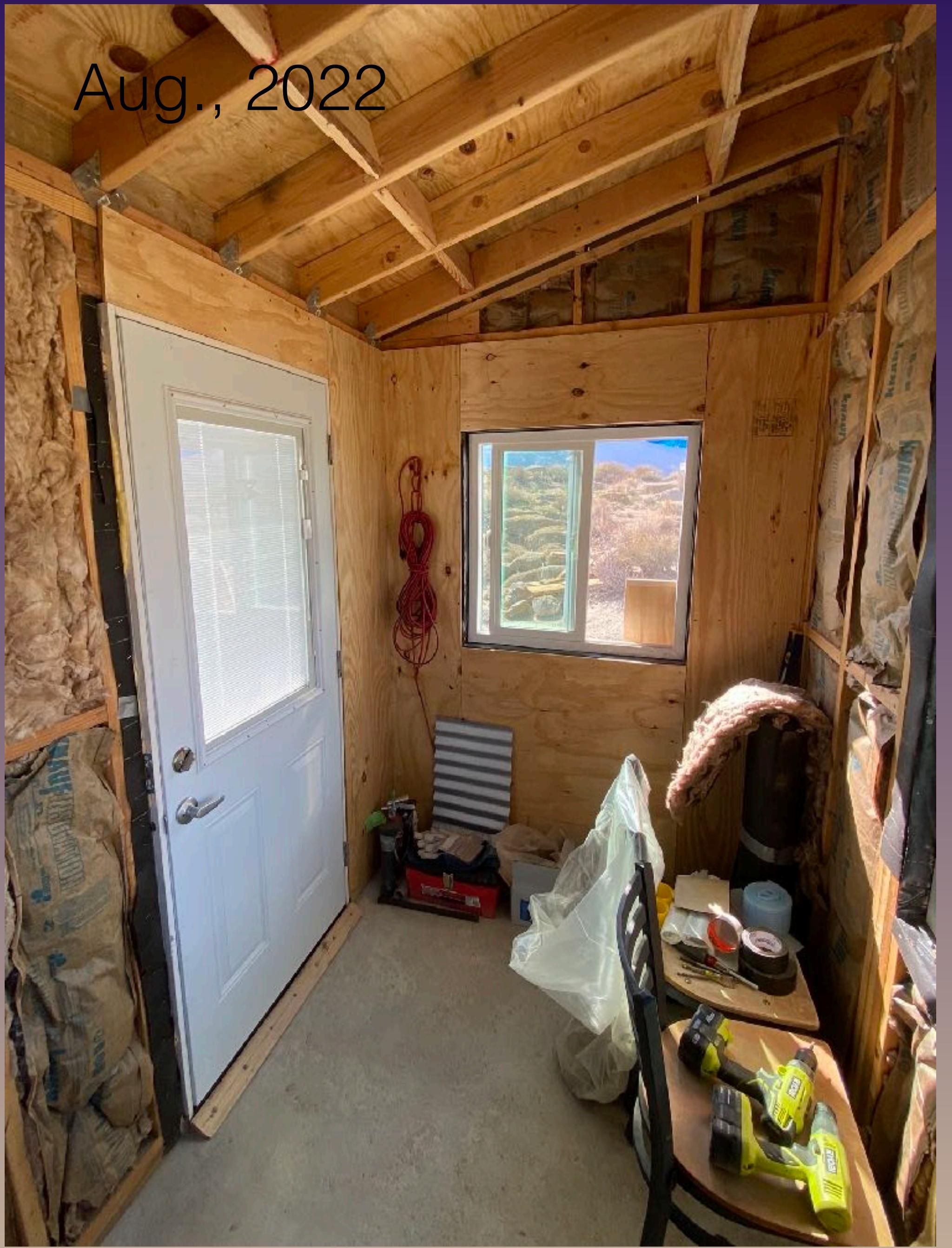
Feb., 2022



Moonlight Operation, April, 2022



Aug., 2022



Sept., 2022





Oct., 2022



Nov., 2022

Custom desk, custom shelf, and LED lighting installed (and observatory declared complete!), Oct. 23, 2022

Sofia Mikulasek (entering class of '22) and Luke Suess (entering class of '21) demonstrating data-taking for visitors, Nov., 3, 2022



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# Teaching and Research Objectives

- General astronomy courses
- Research experience for undergraduates
- Push small telescope operation under dark skies
- Contribute to transient astronomy

# Push small telescope operation under dark skies

*Reporting on work done in collaboration with Geoff Marcy, Sofia Mikulasek, and Luke Suess*

Deep Springs Observatory

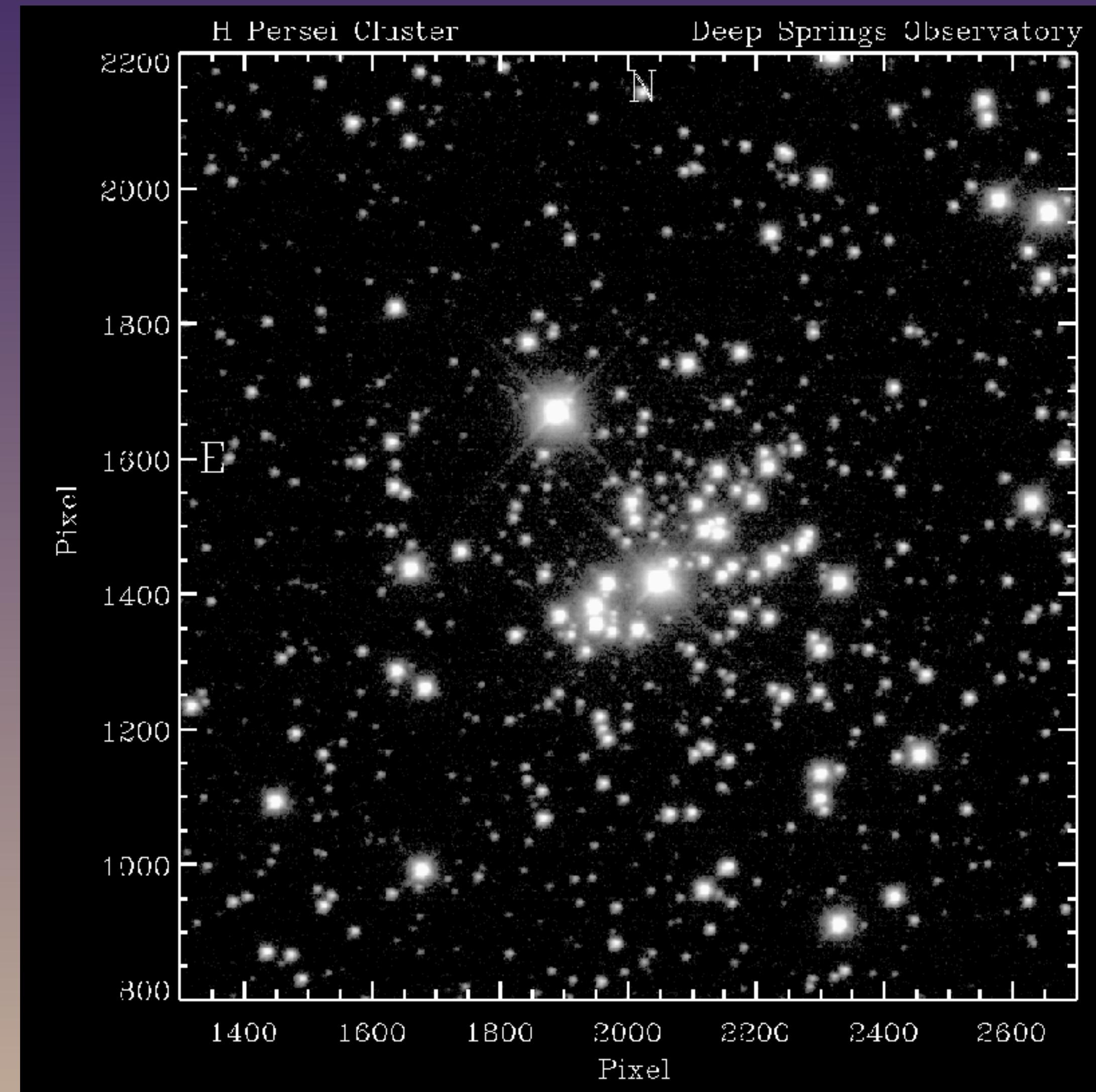
Oct. 18, 2022

10" CFF Telescopes Ritchey-Chrétein

H Persei cluster

CBB filter

30-second exposure



# Push small telescope operation under dark skies

<https://skyview.gsfc.nasa.gov/current/cgi/runquery.pl> with query parameters DSS2 Red, Coordinates = 02 18 51.89, +57 08 59.2, Image Size (degrees) = 0.25

Palomar Observatory

DSS2 Survey

48" Oschin Schmidt Telescope

H Persei cluster

Red filter

40-minute exposure

**Title:** The second Palomar Sky Survey

**Authors:** Reid, I. N., Brewer, C., Brucato, R. J., McKinley, W. R., Maury, A., Mendenhall, D., ,

**Journal:** Astronomical Society of the Pacific, Publications (ISSN 0004-6280), vol. 103, July 1991, p. 661-674. Research supported by California Institute of Technology, NSF, National Geographic Society, et al.

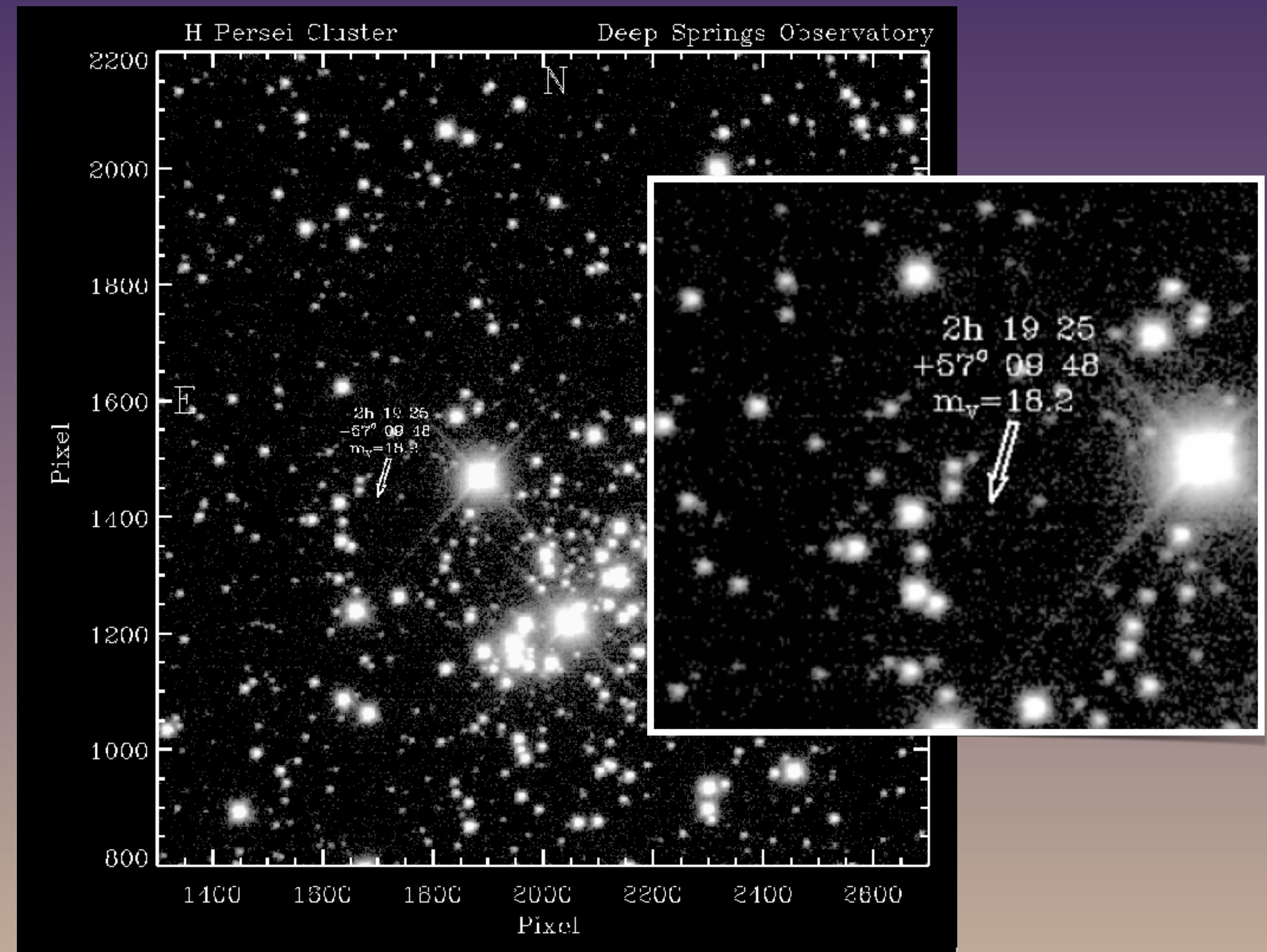
**Bibliographic Code:** 1991PASP..103..661R



# Push small telescope operation under dark skies

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Magnitude 18 stars are  
present in our image with  
3- $\sigma$  confidence



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# Contribute to transient astronomy

<https://www.physics.purdue.edu/brights supernovae/>

All active supernova over mag 17.0				A long time ago, in a galaxy far far away, a star exploded. This star exploded so violently that for a few weeks the star outshone its parent galaxy. This type of explosion is called a <a href="#">Supernova</a> . The last one in our galaxy was 400 years ago, making us about 300 years overdue for the next one. On this web page you will find a list of the currently observable supernovae, along with information on their location, reference images, and their last reported brightness. The data on this page comes from <a href="#">TNS</a> and <a href="#">ATEL</a> circulars. These web pages have brought you the latest in supernovae data and images since April 1997. 25 years and counting.
Name	Mag	Type	Host	
<a href="#">2022zut</a>	13.5	Ia	<a href="#">NGC 3810</a>	
<a href="#">AT2022zfb</a>	14.1	unk	<a href="#">none</a>	
<a href="#">ASASSN-22jp</a>	14.2	Ia	<a href="#">NGC 4415</a>	
<a href="#">AT2022zxb</a>	14.7	unk	<a href="#">none</a>	
<a href="#">2022xkq</a>	15.0	la-91bg	<a href="#">NGC 1784</a>	News: Robert Evans, discoverer of several supernovae (visually) has died. <a href="#">2022zut</a> just popped up at Mag 14.6 in <a href="#">NGC 3810</a> . <a href="#">2022xlp</a> in <a href="#">NGC 3938</a> is rising rapidly. <a href="#">2022pul</a> is out of solar conjunction. I now have a program which finds the names of galaxies. You will notice that the magnitudes of the brighter objects (< 17.0) are now updated more often. We now have an image of <a href="#">2021afdx</a> taken by the <a href="#">JWST</a> . For the <a href="#">year 2022</a> , 16883 supernovae (1772 CBAT, 15111 unconfirmed, and 0 other sources) have been reported. (21098 <a href="#">last year</a> ). The brightest SN of the year 2022 are <a href="#">2022hrs</a> (Mag 12.3) followed by <a href="#">2022ffv</a> (Mag 13.3) and <a href="#">2022fw</a> (Mag 13.5)
<a href="#">2022wsp</a>	15.4	II	<a href="#">NGC 7448</a>	TNS has moved to a new URL: <a href="https://www.wis-tns.org/">https://www.wis-tns.org/</a> . To post your discoveries, go to the <a href="#">TNS getting started page</a> . The <a href="#">Open supernova Catalog</a> has died, links will be removed eventually. Latest Supernovae is now supported by <a href="#">Purdue University</a> and maintains a new <a href="#">mirror</a> hosted in the <a href="#">Department of Physics and Astronomy</a> that is overseen by <a href="#">Dan Milisavljevic</a> . Purdue mirror page: <a href="http://www.physics.purdue.edu/brights supernovae/">http://www.physics.purdue.edu/brights supernovae/</a> .
<a href="#">AT2022aagp</a>	15.8	unk	<a href="#">NGC 2777</a>	
<a href="#">2022yqv</a>	15.9	la-91T	<a href="#">UGC 10984</a>	<b>New features:</b> Modified the <a href="#">sorted by name list</a> to include removed objects and mark "non public" objects. All galactic objects (CV novae, etc) will be banned on a weekly basis to the <a href="#">boneyard</a> . Thanks for all of the images, I have been posting them on <a href="#">flickr</a> . Join the discussion! <a href="#">Facebook Supernova Enthusiasts Group</a> . The <a href="#">Active supernovae page</a> is a version of this page which is designed to be easier to read. I've done extensive work recently in the <a href="#">Archives</a> . If anybody knows who some of the "unknown" discoverers are, please let me know. Does anybody know of a grant that I could apply to for supporting this page? I probably spend about 2 hours a night working on it. Please note my backup e-mail address: dbishopx@gmail.com. To turn off the icons, use this <a href="#">link</a> . With the demise of Yahoo Groups, I am moving isn_chat to <a href="#">Google groups</a> . Please sign up if interested. <a href="#">LOSS</a> ask people who discover supernovae to provide an offset from a nearby star to make spectroscopy easier.
<a href="#">AT2022znu</a>	16.0	unk	<a href="#">none</a>	
<a href="#">2022yvv</a>	16.0	Ia	<a href="#">anonymous</a>	
<a href="#">2022wvt</a>	16.0	Ia	<a href="#">anonymous</a>	Some groups are not reporting all of their discoveries to CBAT.
<a href="#">AT2022zyr</a>	16.1	EGN	<a href="#">M31</a>	<ul style="list-style-type: none"><li>• <a href="#">ASAS-SN: Supernovae</a></li><li>• <a href="#">ATLAS</a> (no published list)</li><li>• <a href="#">Catalina Real-Time Transient Survey</a>:<ul style="list-style-type: none"><li>◦ <a href="#">MLS search page (Supernovae only, Possible supernovae)</a></li><li>◦ <a href="#">Supernova hunt page</a></li></ul></li><li>• <a href="#">Dark Energy Survey</a></li><li>• <a href="#">Gaia Photometric Science Alerts programme Alert index</a></li><li>• <a href="#">La Silla-QUEST</a> (no published list)</li><li>• <a href="#">MASTER robotic Net List of optical transients, Supernovae</a></li><li>• <a href="#">OGLE-IV wide field survey Discovery images Rapid Transient Detection system</a></li><li>• <a href="#">Intermediate Palomar Transient Factory</a> (no published list)</li><li>• <a href="#">PS1 Science Consortium Discoveries</a></li><li>• <a href="#">ROTSE collaboration: Discoveries page</a></li><li>• <a href="#">SkyMapper Supernovae search Zooniverse supernova sighting Results from Supernova Sighting</a></li><li>• <a href="#">SNAD Catalog</a></li><li>• <a href="#">Zwicky Transient Facility (ZTF) Alert archive ZTF Bright Transient Explorer</a></li></ul>
<a href="#">AT2022zjo</a>	16.1	unk	<a href="#">NGC 2152</a>	
<a href="#">2022yvw</a>	16.1	IIb	<a href="#">NGC 1359</a>	
<a href="#">2022ypd</a>	16.1	Ia	<a href="#">MCG +0-52-30</a>	
<a href="#">2022rnt</a>	16.1*	Ia	<a href="#">IC 4790</a>	
<a href="#">2022aaad</a>	16.1	II	<a href="#">none</a>	
<a href="#">AT2022xyg</a>	16.2*	unk	<a href="#">ESO 271-G26</a>	
<a href="#">AT2022xxs</a>	16.2*	unk	<a href="#">none</a>	
<a href="#">AT2022wic</a>	16.2*	unk	<a href="#">none</a>	
<a href="#">2022ypb</a>	16.2	Ia-91T	<a href="#">LEDA 918265</a>	
<a href="#">AT2022zks</a>	16.3	unk	<a href="#">none</a>	
<a href="#">AT2022ynz</a>	16.3*	unk	<a href="#">none</a>	
<a href="#">ASASSN-22my</a>	16.3	Ia	<a href="#">NGC 946</a>	Other versions of this list, going back 18 months (see the <a href="#">archives</a> )
<a href="#">AT2022zue</a>	16.4	unk	<a href="#">LEDA 1021768</a>	<ul style="list-style-type: none"><li>• <a href="#">Active objects</a> (Machine readable version of main page)</li><li>• <a href="#">Sorted by Location (R.A.)</a></li><li>• <a href="#">Sorted by Location (Decl)</a></li><li>• <a href="#">Sorted by Date</a></li><li>• <a href="#">Sorted by Magnitude</a></li><li>• <a href="#">Sorted by Red Shift</a></li><li>• <a href="#">Sorted by Host name</a></li><li>• <a href="#">Sorted by Name</a></li><li>• <a href="#">Statistics</a></li></ul>
<a href="#">AT2022ztk</a>	16.4	unk	<a href="#">LEDA 924001</a>	Other versions of this list, For the year 2022 (see the <a href="#">archives</a> )
<a href="#">2022xzm</a>	16.5	Ic-BL	<a href="#">CGCG 478-048</a>	<ul style="list-style-type: none"><li>• <a href="#">Sorted by Location (R.A.)</a></li><li>• <a href="#">Sorted by Location (Decl)</a></li><li>• <a href="#">Sorted by Date</a></li><li>• <a href="#">Sorted by Magnitude</a></li><li>• <a href="#">Sorted by Red Shift</a></li><li>• <a href="#">Sorted by Host name</a></li><li>• <a href="#">Sorted by Name</a></li><li>• <a href="#">Statistics</a></li></ul>
				Other versions of this list, For the year 2021 (see the <a href="#">archives</a> )
				<ul style="list-style-type: none"><li>• <a href="#">Sorted by Location (R.A.)</a></li><li>• <a href="#">Sorted by Location (Decl)</a></li><li>• <a href="#">Sorted by Date</a></li><li>• <a href="#">Sorted by Magnitude</a></li><li>• <a href="#">Sorted by Red Shift</a></li><li>• <a href="#">Sorted by Host name</a></li><li>• <a href="#">Sorted by Name</a></li><li>• <a href="#">Statistics</a></li></ul>

# Contribute to transient astronomy

*Reporting on work done in collaboration with Geoff Marcy, Sofia Mikulasek, and Luke Suess*

Deep Springs Observatory

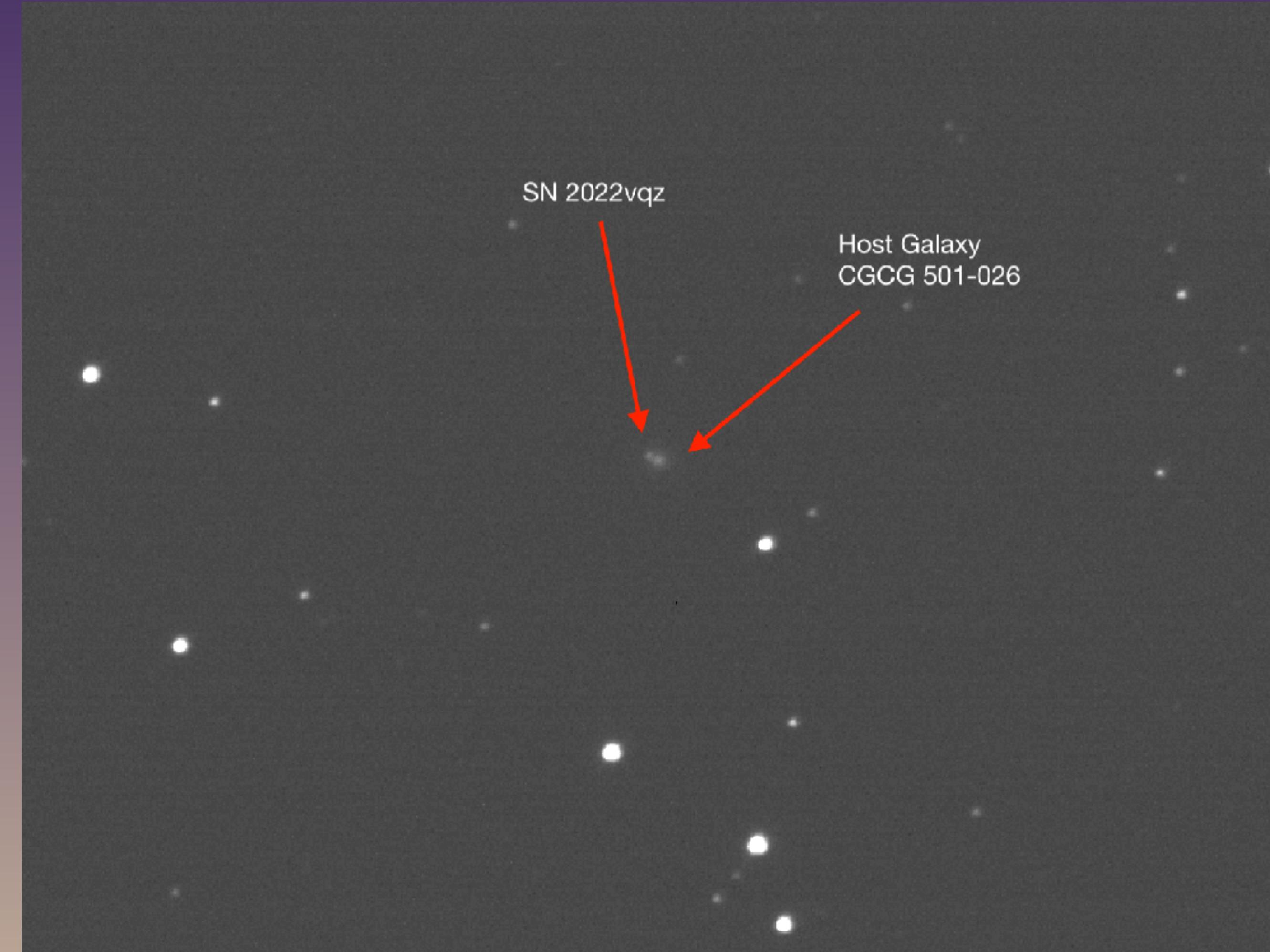
Oct. 24, 2022

10" CFF Telescopes Ritchey-Chretein

SN 2022vqz

CBB filter

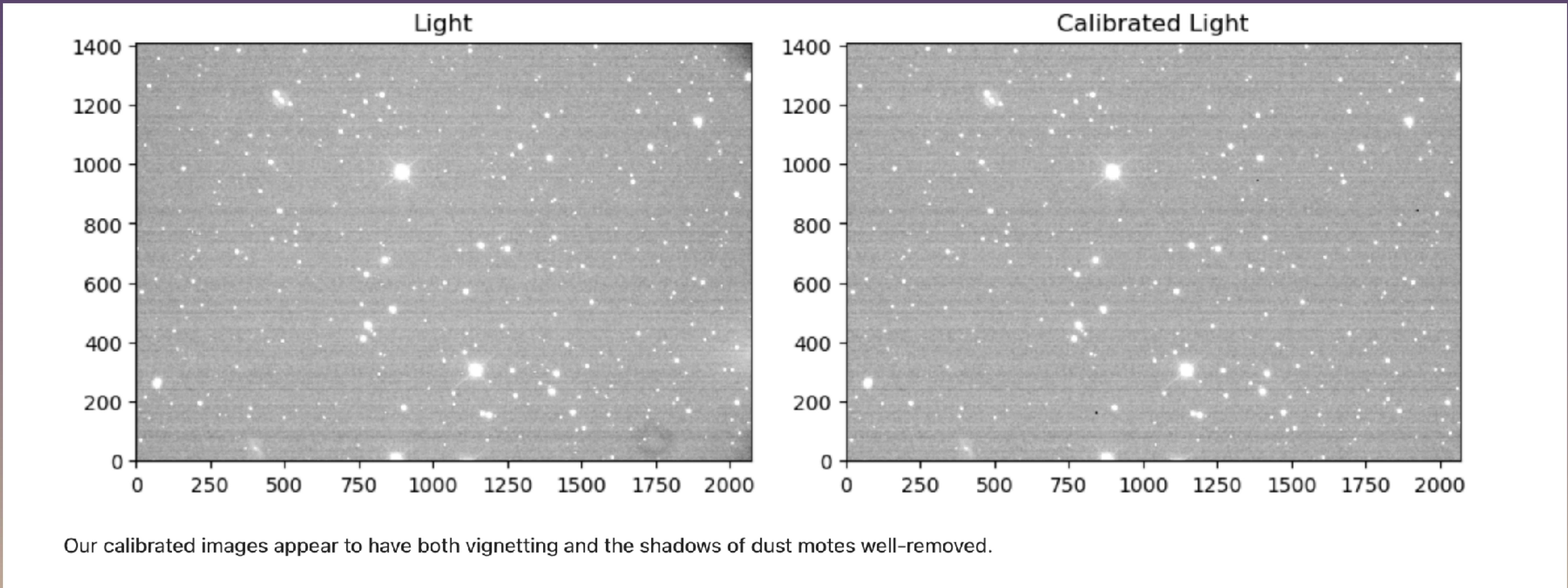
30-second exposure



# Contribute to transient astronomy

*Since the observations on Oct. 24th (for the last three weeks) we have been building a data-processing pipeline in Python:*

[http://github.com/brianhill/transient-astronomy/blob/master/analyses/2022-10-2425-SN\\_2022vqz/analysis-brian.ipynb](http://github.com/brianhill/transient-astronomy/blob/master/analyses/2022-10-2425-SN_2022vqz/analysis-brian.ipynb)



# Conclusion

- Thank you for keeping the basin and range skies dark!!
- We can collaborate with BRDSC researchers to measure zenith brightness at our location (and also the brightness in the west in the direction of Bishop's or Fresno's light dome?).
- Astronomers: arrange a visit and kibitz. We always appreciate pointers, and we built our observatory so that it is easy to set up other equipment in it (tripods currently — no permanent pier — yet!).
- Expect quality supernovae photometry from us in a few months.
- Geoff, Sofia, Luke, and I will be continuously updating our progress during this winter and the spring of 2023 here:

<https://brianhill.github.io/transient-astronomy>

- To contact me prior to visiting: brianhill (at) deepsprings (dot) edu

