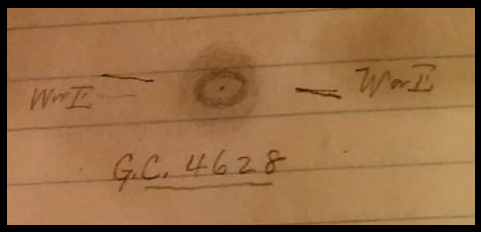
PRIMEFOCUS

Tri-Valley Stargazers

February 2016



Meeting Info

What:
Searching for the First Stars Through Nuclear Reactions

Who:
Dr. Brian Bucher

When:
February 19, 2016
Doors open at 7:00 p.m.
Meeting at 7:30 p.m.
Lecture at 8:00 p.m.

Where:
Unitarian Universalist Church in Livermore
1893 N. Vasco Road

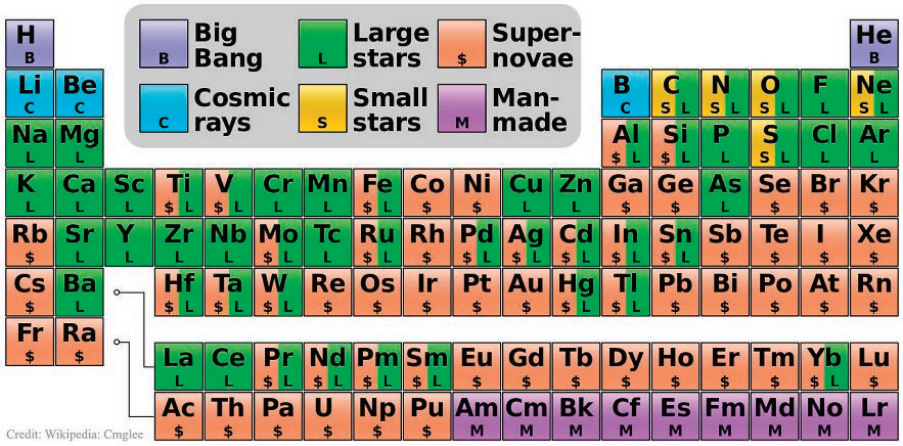
Inside

February Meeting

Searching for the First Stars Through Nuclear Reactions

Dr. Brian Bucher

Over the years, the interplay between nuclear physics, computational astrophysics, and observational astronomy has been critical to our understanding of the cosmos. Nuclear data and astrophysical models continue to provide key input to help explain and guide astronomical observations. One recent example involves the search for the first generation of stars in the galaxy, which is predicted to have a rather unique chemical abundance signature compared to later generations of stars whose composition has been enriched with heavy metals. The predicted



Caption: Periodic table of the elements indicating our current understanding of the environments in which they originated. Credit: Cmglee (own work) Creative Commons Attribution-Share Alike 3.0 Unported via Wikimedia Commons

chemical abundance patterns depend sensitively on available nuclear data, among other factors. One important nuclear reaction is the fusion of two carbon nuclei into a magnesium nucleus and a free neutron. In the past, many astrophysical models simply ignored this reaction because the available rate estimates were so uncertain. Now, however, a precise measurment of this reaction at astrophysical conditions has finally been provided using a laboratory accelerator. With the new measurement, it is found that this reaction is critical to the production of elements with odd atomic numbers (e.g., sodium, Z=11) in the first stars while also important to heavy-element synthesis in later stellar generations.

Brian Bucher grew up in northwest Indiana and received his bachelor's degree in physics from Valparaiso University. He went on to study nuclear astrophysics at the University of Notre Dame where he received his Ph.D. in 2014 before coming to Lawrence Livermore National Lab as a postdoctoral researcher. In his free time, he enjoys reading, cooking, and playing video games with his four young boys.

News & Notes

2016 TVS Meeting Dates

The following lists the TVS meeting dates for 2016. The lecture meetings are on the third Friday of the month, with the Board meetings on the Monday following the lecture meeting.

Lecture Meeting	**Board Meeting**	Prime Focus **Deadline**
Feb. 19	Feb. 22	
Mar. 18	Mar. 21	Feb. 26
Apr. 15	Apr. 18	Mar. 25
May 20	May 23	Apr. 29
Jun. 17	Jun. 20	May 27
Jul. 15	Jul. 18	Jun. 24
Aug. 19	Aug. 22	Jul. 29
Sep. 16	Sep. 19	Aug. 26
Oct. 21	Oct. 24	Sep. 30
Nov. 18	Nov. 21	Oct. 28
Dec. 16	Dec. 19	Nov. 25

Money Matters

As of February 10, 2016 the TVS checking account balance is $12,626.98.

TVS 2016 Dues are Due

While renewal is ahead of last year's pace, about thirty 2015 members have yet to renew. You can join TVS or renew your membership online at:

http://www.trivalleystargazers.org/membership.shtml Alternatively, you can mail in the Membership Application on the last page of this newsletter along with a check to the Tri-Valley Stargazers, P.O. Box 2476, Livermore, CA 94551-2476. Note that TVS will not share your information with anyone. We only use the e-mail address to notify you when the newsletter becomes available.

All members agree to hold the Tri-Valley Stargazers, and any cooperating organizations or landowners, harmless from all claims of liability for any injury or loss sustained at a TVS function.

Astroscan for Sale

TVS acquired an Astroscan that was kindly donated to the club. It's in fine working condition and includes a 28mm eyepiece, dust cap, shoulder strap, and table-top stand. Astroscan telescopes are highly portable wide-field telescopes, but since we already have another Astroscan in our loaner telescope collection, we're offering this one for sale to any interested club member. We're offering it for $100 and will have it available to look through at the February meeting. Astroscans are no longer produced and have become popular collectors' items. Used Astroscans routinely sell for more than this on eBay.

Calendar of Events

February 16, 12:00pm

What: Potentially Biogenic Carbon preserved in a 4.1 Billion Year Old Zircon
Who: Elizabeth Bell, UCLA
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Although our planet is approximately 4.5 billion years old (Ga), Earth's fossil record extends only to 3.5 Ga, the chemofossil record arguably to 3.8 Ga, and the rock record to 4.0 Ga. However, detrital zircons from Jack Hills, Western Australia range in age up to nearly 4.4 Ga. From a population of over 10,000 zircons from this locality, we identified one 4.10 Ga zircon that contains primary graphite inclusions in a crack-free region, and report carbon isotopic measurements on the graphite. Evidence for carbon cycling or biologic activity can be derived from carbon isotopic studies, since a high ratio of 12C/13C is characteristic of biogenic carbon. The 12C-rich isotopic signature of these graphite inclusions is consistent with a biogenic origin and may be evidence that a terrestrial biosphere had emerged by 4.1 Ga, or ~300 million years earlier than has been previously proposed.

For more information see: http://www.seti.org/csc/lectures, e-mail info@seti.org, or phone 650-961-6633.

February 20, 11:00am-12:30pm

What: Shining Light on Dark Matter & Dark Energy
Who: Holger Müller, UC Berkeley
Where: UC Berkeley, 159 Mulford Hall
Cost: Free, limited hourly pay parking on/nearby campus. The venue is within walking distance of BART and bus lines.

Dr. Müller will give an overview of recently proposed experiments and theoretical models of dark matter and dark energy. The standard model of particle physics has been enormously successful, yet unable to account for dark matter and dark energy – mysterious stuff whose gravity holds galaxies together and drives the accelerated expansion of the universe, respectively. Physicists have long assumed that the dark sector would at least partially consist of new, relatively massive particles, but have not been able to turn up uncontested evidence for them. A dark sector made of very light particles, however, could have escaped detection in any experiment conducted so far, yet is compatible with all astronomical and cosmological evidence.

For more information see: http://scienceatcal.berkeley.edu/the-sciencecal-lecture-series/

Header Image: Drawing of Planetary Nebula GC4628 by J. E. Keeler from August 22, 1890. I believe this to be the Cat's Eye Nebula, now known as NGC7009. Image Credit: Ken Sperber

Calendar of Events (continued)

February 22, 7:30pm

What: Calling the Cosmos: How to Talk with Extraterrestrials
Who: Dr. Douglas Vakoch, President, SETI International
Where: California Academy of Science, 55 Music Concourse Dr., Golden Gate Park, San Francisco, CA
Cost: Advanced ticketing required. Academy members $8 , Seniors $10, General $12. Reserve a space online or call 1-877-227-1831.

For over a half century, astronomers engaged in SETI—the Search for Extraterrestrial Intelligence—have pointed radio telescopes to the heavens, seeking scientific evidence for life beyond Earth. If we succeed in detecting a signal from another world, what should we say in response? Should we do more, right now, to make ourselves known in the universe, even before first contact? Or is it dangerous to shout in the cosmos when we don't know who's out there? Dr. Vakoch will take you on a journey through our solar system and beyond as he explores the Pioneer plaque and the Voyager recording that are carried on spacecraft launched by NASA, placed there on the unlikely chance that these spacecraft, now drifting aimlessly through the galaxy, will someday be intercepted by advanced civilizations. Dr. Vakoch will argue that we should move beyond the symbolic messages that we've already sent into the cosmos. Instead, we should begin an ambitious project to transmit powerful, information-rich messages to nearby stars. If we can succeed in explaining to extraterrestrials what it's like to be human, we might even intrigue them enough to get a reply.

See www.calacademy.org/events/benjamin-dean-astronomy-lectures for lecture and reservation information.

February 23, 12:00pm

What: The Breakthrough Initiative - Listen and Megastructures at KIC 8463
Who: Andrew Siemion, UC Berkeley
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Dr. Andrew Siemion, Director of the Berkeley SETI Research Center (BSRC) at the University of California, Berkeley, will present an overview of the Breakthrough Listen Initiative, 100-million-dollar, 10-year search for extraterrestrial intelligence. Dr. Siemion will also discuss other SETI efforts ongoing at the BSRC, including the successful citizen science project SETI@Home, as well as a concerted effort to undertake panchromatic observations of the mysterious Kepler star KIC 8462852.

For more information see: http://www.seti.org/csc/lectures, e-mail info@seti.org, or phone 650-961-6633.

February 27, 7:00-10:00pm

What: New Sci-fi Lecture Series
Who: Scott Hutchins
Where: Chabot Space and Science Center, 10000 Skyline Blvd., Oakland, CA 94619
Cost: Adults $15

Scott Hutchins is a former Truman Capote fellow in the Wallace Stegner Program at Stanford University, where he teaches Creative Writing. His work has been featured in numerous publications including the New York Times, San Francisco Magazine and StoryQuarterly. During his talk, Hutchins will explore the intersection of science and science fiction in his debut novel and San Francisco Chronicle's Best Book of 2012, A Working Theory of Love.

Wine and beer will be available for purchase.

See http://www.chabotspace.org/events.htm for more information, or call (510) 336-7373..

March 1, 12:00pm

What: Bringing Nuclear Power to Mars
Who: Frank H. Shu, University Professor Emeritus,

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UC Berkeley
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Establishing a lunar base is probably a wise first step to colonizing Mars. The bare minimum for sustaining life on the Moon exists in the water brought by comets to the bottoms of some lunar craters. Electrolysis of this dirty water can produce clean oxygen (and hydrogen) for the lunar base. Nuclear power is the default option, just as is the case of naval submarines where the crews need to live and work in closed environments submerged under the water of the ocean for months at a time. However, the light water reactors of naval submarines are not a good choice for environments that lack large bodies of water, and we argue that molten salt reactors, of the type invented by Oak Ridge National Lab in the 1960s, are much better suited for a lunar base, or for that matter, a Mars colony. Dr. Shu will then discuss his patented design for the best possible two-fluid molten-salt breeder-reactor (2F-MSBR) that one could build, using thorium that can be mined locally without requiring shipments from mother Earth. He will close by considering two spin-off applications:

(1) saving civilization on Earth from the worst ravages of climate change by scaled-up 2F-MSBRs;

(2) using the fission fragments of related nuclear fission reactions for ion-propulsion that produces rockets two to three orders of magnitude faster than achievable with chemical rockets, making possible, perhaps, a first generation of starships.

For more information see: http://www.seti.org/csc/lectures, e-mail info@seti.org, or phone 650-961-6633

March 8, 12:00pm

What: Exploring the Outer Solar System: Now in Vivid Colour
Who: Michele Bannister, University of Victoria
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

The outer reaches of our Solar System are home to hundreds of thousands of small icy worlds. Their present orbits are a sculpted signature of the early migrations of the giant planets, particularly Neptune. Yet the faintness and highly eccentric orbits of most of these worlds mean only a tiny fraction of them have yet been discovered. With the Outer Solar System Origins Survey on CFHT, we are discovering up to five hundred new outer Solar System objects, with exquisitely well-determined orbital parameters. Our complementary Large Program on Gemini North is observing the brightest of our discoveries in the optical and infrared with unprecedented precision, providing information on the ices, silicates and organic compounds on the surfaces of these small worlds. This colourful map of the structure of the outer Solar System is providing new constraints on Neptune's migration.

For more information see: http://www.seti.org/csc/lectures, e-mail info@seti.org, or phone 650-961-6633.

March 14, 7:30pm

What: How Will the World End: Death Plunge or Death Spiral?
Who: Dr. Mark Boslough, University of New Mexico
Where: California Academy of Science, 55 Music Concourse Dr., Golden Gate Park, San Francisco, CA
Cost: Advanced ticketing required. Academy members $8 , Seniors $10, General $12. Reserve a space online or call 1-877-227-1831.

Which would be worse for life on Earth: an asteroid impact or a global warming catastrophe? Dr. Boslough compares the "death plunge" of an asteroid into Earth's atmosphere and the resulting effects of an impact to the "death spiral" of irreversible human-caused change in the planet's climate and discusses whether one is more likely—or preventable—than the other.

See www.calacademy.org/events/benjamin-dean-astronomy-lectures for lecture and reservation information.

March 15, 12:00pm

What: Surviving a methane monsoon: the bizarre cryo genic rains, flammable dunes and carbon hazes of Saturn's planet-moon, Titan
Who: Michael Carroll
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

In this talk, Author/artist Michael Carroll will explore the bizarre methane-filled seas and soaring dunes of Saturn's largest moon, Titan. Recent advances in our understanding of this planet-sized moon provide enough information for authors to paint a realistic picture of this truly alien world. Following his presentation, he will be signing his new science fiction adventure/mystery book, "On the Shores of Titan's Farthest Sea".

"Carroll's descriptions of oily seas and methane monsoons put you in that alien world, front and center…I can imagine future astronauts doing exactly the kinds of things Mike describes. I wish I could be one of them." Alan Bean, Apollo 12 astronaut.

For more information see: http://www.seti.org/csc/lectures, e-mail info@seti.org, or phone 650-961-6633.

Image Caption: Lick Observatory log books of E. E. Barnard, J. M. Schaeberle, E. S. Holden, and J. E. Keeler from the later 19th Century were on display at the January 2016 TVS Meeting, courtesy of Dr. Paul Lynam. Image Credit: Ken Sperber.

Journal Club By Ken Sperber

Lick Observatory Observing Logs

At last month's club meeting, Dr. Paul Lynam, a staff astronomer at Lick Observatory, gave a presentation on "The History and Science of Lick Observatory." His talk chronicled the life of James Lick, and highlighted the pioneering research that has been performed at Lick Observatory since its inception. As a special treat, he brought along observing logs from some of the most famous astronomers of the late 19th Century, including E. E. Barnard, J. M. Schaeberle, E. S. Holden, and J. E. Keeler (see above photo).

E. S. Holden was the first director of Lick Observatory, serving in that capacity from 1888-1897. His summary report of the work at Lick during his tenure can be found at: http://rstl.royalsocietypublishing.org/content/154/1 Prior to that he was president of the University of California (1885-1888). Earlier, in 1877, he claimed to have discovered a 3rd moon of Mars, shortly after Phobos and Deimos were discovered. In early February 1889 Lick astronomers and members of the Pacific Coast Photographic Association met in San Francisco to view images of the New Year's day total solar eclipse. Impressed with the amateurs' contributions, he proposed the formation of The Astronomical Society of the Pacific to foster the intersection of professional and amateur astronomers. In his log book, drawings of Uranus and the locations of its moons, dated February 1, 1890 are seen, as well as the identification of a white spot in the rings of Saturn.

E. E. Barnard is of course known for the discovery of Barnard's Star, the star with the largest proper motion across the sky, moving at about 10.3 arc seconds/year. It is a red dwarf of magnitude 9.5, located about 6 light years from Earth. As an amateur he discovered his first comet in 1881. Though he found the comet again on the next night, he could not find it thereafter; thus he never made an official report. For five subsequent discoveries he was awarded $200/each by H. H. Warner. Barnard helped pioneer astrophotography, which served his interest in dark nebulae, finding that they were clouds of gas and dust. Among his list of 370 dark nebulae, B33 is perhaps the most famous, being the familiar Horsehead Nebula! He also discovered Barnard's Loop, an arc of Hydrogen-alpha emission that abuts the eastern side of the Orion constellation. In his log book is a drawing of Jupiter's Great Red Spot, with accompanying white spots and dark spots that "are less than a shadow (in transit Io) and are not near so black as the shadow and appear to be affected by penumbra." For a biography of E. E. Barnard see: http://adsabs.harvard.edu//full/seri/ApJ../0058//0000001.000.html

J. E. Keeler had short tenures at Lick Observatory, from 1888-1891 as a staff astronomer, and as Director from 1898 until his death in 1900. He was the first to observe the Encke Gap in Saturn's rings. A smaller gap in the A-Ring discovered by Voyager was named in honor of Keeler. At Allegheny Observatory his spectrographic observations showed that the doppler shift of Saturn's rings varied as a function of their distance from Saturn. This proved that the rings were not rotating as a solid body, concluding that "The hypothesis that the rings of Saturn are composed of an immense multitude of comparatively small bodies revolving around Saturn in circular orbits has been firmly established since the publication of (James Clerk) Maxwell's classical paper in 1859" (see: http://adsabs.harvard.edu/doi/10.1086/140074). Keeler's Lick Observatory log book demonstrates his wide-ranging interests, with entries on various stars, the Pleiades, the Orion Nebula, spectra of nebulae, Jupiter's Red Spot,

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What's Up By Ken Sperber (adapted from S&T and The Year in Space)

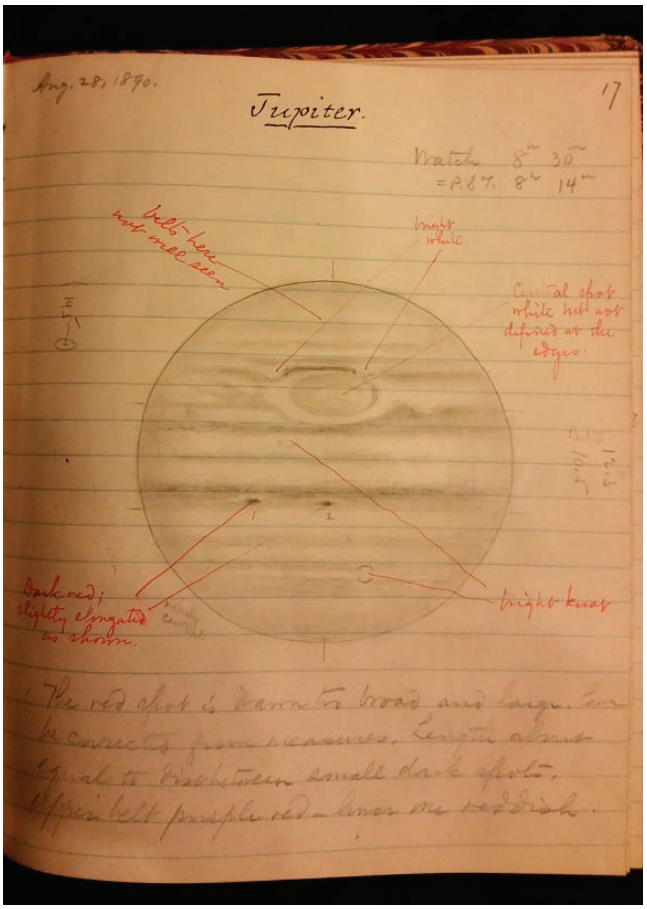
All times are Pacific Standard Time until March 13 when Pacific Daylight Time begins.

February

14	Sun	First-Quarter Moon (11:46pm)
15-16	Mon-	The Moon occults Aldebaran (1:03am on the 16th; see p.45, February S&T)
18	Thu	Algol at minimum brightness for 2 hours centered on 7:50pm
22	Mon	Full Moon (10:20am)
23	Tue	Watch the Moon move eastward relative to Jupiter
29	Mon	Mars about 5 degrees below the Moon (morning)

March

1	Tue	Last-Quarter Moon (3:11pm)
1	Tue	The Moon is between Mars and Saturn (morning)
2	Wed	The Moon is 4 degrees left of Saturn and they rise in tandem (~1-2am)
7	Mon	Crescent Moon rises left of Venus (1 hour before sunrise)
9	Wed	New Moon (5:54m)
14	Mon	First-Quarter Moon (10:03am)
14	Mon	Double Shadow Transit on Jupiter (7:22pm-9:34pm)



shadow transits of Jupiter, and Planetary Nebulae. His drawings are exquisitely detailed as evidenced by his August 28, 1890 drawing of Jupiter (see left; Image Credit: Ken Sperber). For his discussion of photographing Planetary Nebulae, see: http://cdsads.u-strasbg.fr/cgi-bin/nph-bib_query?1899ApJ....10..193K&db_key=AST&nosetcookie=1

J. M. Schaeberle served at Lick Observatory from its inception until 1898, when he resigned due to J. E. Keeler being named Director instead of him. Earlier, from 1876-1888, he taught astronomy at the University of Michigan, though his training was as a civil engineer. During his tenure at Lick, he designed a camera to take pictures of the solar corona. As such, he ventured to the solar eclipses of 1889 (French Guiana), 1893 (Chile), and Japan (1896). He also discovered 3 comets and Procyon B, the latter of which is documented in his log book. His 1897 photographs of Jupiter are included in his article in the Astronomical Society of the Pacific, see: http://www.jstor.org/stable/40667779?seq=1#page_scan_tab_contents

For more information see: http://astrosociety.org/, https://en.wikipedia.org/wiki/Edward_S._Holden, https://en.wikipedia.org/wiki/Edward_Emerson_Barnard, https://en.wikipedia.org/wiki/Barnard's_Star, https://en.wikipedia.org/wiki/James_Edward_Keeler, https://en.wikipedia.org/wiki/John_Martin_Schaeberle

I thank Gert Gottschalk for clarifying the contents of the log book of J. M. Schaeberle.

The Loneliest Galaxy In The Universe

By Dr. Ethan Siegel

Our greatest, largest-scale surveys of the universe have given us an unprecedented view of cosmic structure extending for tens of billions of light years. With the combined effects of normal matter, dark matter, dark energy, neutrinos and radiation all affecting how matter clumps, collapses and separates over time, the great cosmic web we see is in tremendous agreement with our best theories: the Big Bang and General Relativity. Yet this understanding was only possible because of the pioneering work of Edwin Hubble, who identified a large number of galaxies outside of our own, correctly measured their distance (following the work of Vesto Slipher's work measuring their redshifts), and discovered the expanding universe.

But what if the Milky Way weren't located in one of the "strands" of the great cosmic web, where galaxies are plentiful and ubiquitous in many different directions? What if, instead, we were located in one of the great "voids" separating the vast majority of galaxies? It would've taken telescopes and imaging technology far more advanced than Hubble had at his disposal to even detect a single galaxy beyond our own, much less dozens, hundreds or millions, like we have today. While the nearest galaxies to us are only a few million light years distant, there are voids so large that a galaxy located at the center of one might not see another for a hundred times that distance.

While we've readily learned about our place in the universe from observing what's around us, not everyone is as fortunate. In particular, the galaxy MCG+01-02-015 has not a single known galaxy around it for a hundred million light years in all directions. Were you to draw a sphere around the Milky Way with a radius of 100 million light years, we'd find hundreds of thousands of galaxies. But not MCG+01-02-015; it's the loneliest galaxy ever discovered. Our Milky Way, like most galaxies, has been built up by mergers and accretions of many other galaxies over billions of years, having acquired stars and gas from a slew of our former neighbors. But an isolated galaxy like this one has only the matter it was born with to call its own.

Edwin Hubble made his universe-changing discovery using telescope technology from 1917, yet he would have found absolutely zero other galaxies at all were we situated at MCG+01-02-015's location. The first visible galaxy wouldn't have shown up until we had 1960s-level technology, and who knows if we'd have continued looking? If we were such a lonely galaxy, would we have given up the search, and concluded that our galaxy encompassed all of existence? Or would we have continued peering deeper into the void, eventually discovering our unusual location in a vast, expanding universe? For the inhabitants of the loneliest galaxy, we can only hope that they didn't give up the search, and discovered the entire universe.

This article is provided by NASA Space Place. With articles, activities, crafts, games, and lesson plans, NASA Space Place encourages everyone to get excited about science and technology. Visit spaceplace.nasa.gov to explore space and Earth science!

Image Caption: The loneliest void galaxy in the known universe: MCG+01-02-015. Credit: ESA/Hubble & NASA and N. Gorin (STScI); Acknowledgement: Judy Schmidt.

Tri-Valley Stargazers
P. O. Box 2476
Livermore, CA 94551
www.trivalleystargazers.org

Tri-Valley Stargazers Membership Application

(or apply for membership online: *www.trivalleystargazers.org/membership.shtml)*

Contact information:

Name: _____ Phone: _____

Street Address: _____

City, State, Zip: _____

Email Address: _____

Status (select one): _____ New member _____ Renewing or returning member

Membership category (select one): Membership term is for one calendar year, January through December.

_____ Student member ($5). Must be a full-time high-school or college student.

_____ Regular member ($30).

_____ Patron member ($100). Patron membership grants use of the club's 17.5" reflector at H2O. You must be a member in good standing for at least one year, hold a key to H2O, and receive board approval.

Hidden Hill Observatory Access (optional):

_____ One-time key deposit ($20). This is a refundable deposit for a key to H2O. New key holders must first hear an orientation lecture and sign a usage agreement form before using the observing site.

_____ Annual access fee ($10). You must also be a key holder to access the site.

Magazine Subscriptions (optional): Discounted subscriptions are available only to new subscribers. All subsequent renewals are handled directly with the magazine publishers.

_____ One-year subscription to Sky & Telescope magazine ($32.95).

_____ One-year subscription to Astronomy magazine ($34).

Donation (optional):

_____ Tax-deductible contribution to Tri-Valley Stargazers

Total enclosed: $ _____

Member agrees to hold Tri-Valley Stargazers, and any cooperating organizations or landowners, harmless from all claims of liability for any injury or loss sustained at a TVS function. TVS will not share information with anyone other than other club members and the Astronomical League without your express permission.

Mail this completed form along with a check to: Tri-Valley Stargazers, P.O. Box 2476, Livermore, CA 94551.