

PRIMEFOCUS

Tri-Valley Stargazers



November 2019



Meeting Info Cosmochemical constraints on the evolution of the Solar System

Who:

Dr. Thomas Kruijer

When:

November 15, 2019
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

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November Meeting

Cosmochemical constraints on the earliest evolution of the Solar System

By Thomas Kruijer, Lawrence Livermore National Laboratory

Cosmochemistry, the study of chemical and isotopic signatures of meteorites, can provide direct constraints on the origin and evolution of the Solar System. As a discipline, it therefore, represents an important complement to fields like astronomy and astrophysics. Here I will review recent developments in cosmochemistry, and discuss several important implications for the dynamics of the early Solar System. From a cosmochemist's viewpoint, the evolution of the solar protoplanetary disk started with the formation of the oldest dated solids, Ca-Al-rich inclusions (CAIs), which formed ~4.567 billion years ago. A second important step in early Solar System evolution is the formation of the first ~km-sized bodies known as planetesimals. Recent isotope studies of iron meteorites—metal samples of small planetesimal cores—demonstrate that core segregation in their parent bodies occurred within the first ~1-3 million years (Myr) after CAIs. Consequently, the formation of iron meteorite parent bodies occurred even earlier, well within <1 Ma of Solar System formation, demonstrating that planetesimals formed very early. Recent work has shown that meteorites exhibit a fundamental isotopic dichotomy between non-carbonaceous (NC) and carbonaceous (CC) groups, which most likely represent material from the inner and outer Solar System, respectively. The NC-CC dichotomy combined with the ages of meteorites mandate an early and prolonged spatial separation of inner (NC) and outer (CC) solar protoplanetary disk reservoirs, lasting between ~1 and ~4 Myr after Solar System formation. This is most easily reconciled with the early and rapid growth of Jupiter's core, inhibiting significant exchange of material from inside and outside its orbit. An important consequence of this finding is that Jupiter is the oldest planet of the Solar System and its solid core must have formed well within <1 Ma after CAIs.

Thomas Kruijer is a cosmochemist and planetary scientist working as a postdoctoral researcher in the Nuclear and Chemical Sciences Division at Lawrence Livermore National Laboratory. He received his PhD from ETH Zürich (Switzerland) in 2013 and subsequently worked at the University of Münster (Germany) before moving to the lab in 2017. His research is aimed at determining the origin, accretion, and early evolution of planets. In particular, he attempts to reconstruct the processes and chronology of events that occurred during the earliest stages of Solar System, more than 4.5 billion years ago. To this end, he measures small-scale isotopic variations in extraterrestrial rock samples, such as meteorites and lunar rocks, by utilizing isotope ratio mass spectrometry techniques. Thomas has used the isotopic signatures of such samples to study diverse aspects of early Solar System evolution, including: (i) the early evolution of the solar protoplanetary disk, (ii) the origin, accretion, and core formation history of protoplanets, (iii) the genetic heritage of planetary building blocks, (iv) the formation and early evolution of larger planetary bodies such as the Earth, Mars, and Jupiter, and (v) the origin and early evolution of the Moon.

News & Notes

2019-2020 TVS Meeting Dates

Below are the TVS meeting dates for 2019-2020. 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
Nov. 15	Nov. 18	Nov. 01
Dec. 20	Dec. 23	Dec. 06
Jan. 17	Jan. 20	Jan. 03
Feb. 21	Feb. 24	Feb. 07
Mar. 20	Mar. 23	Mar. 06
Apr. 17	Apr. 20	Apr. 03
May 15	May 18	May 01
Jun. 19	Jun. 22	Jun. 05
Jul. 17	Jul. 20	Jul. 03
Aug. 21	Aug. 24	Aug. 07
Sep. 18	Sep. 21	Sep. 04
Oct. 16	Oct. 19	Oct. 02
Nov. 20	Nov. 23	Nov. 06
Dec. 18	Dec. 21	Dec. 04

Money Matters

As of the last Treasurer's Report on 10/21/19, our club's checking account balance is \$13,226.

TVS Elections at the November Meeting

TVS will hold its annual election at the November 15 meeting. Roland Albers will present the slate of candidates, and election is by acclamation. The present nominations are:

- President: Roland Albers
- Vice President: Eric Dueltgen
- Secretary: Ross Gaunt
- Treasurer: Jenny Siders

Outreach Star Party

November 13: Marylin Avenue School, Livermore, set-up at 6:00pm

Time to Renew Club Membership for 2020

Now is a great time to become part of TVS. Membership is open to anyone with an interest in astronomy. Amateurs and professionals are equally welcome; skilled amateurs comprise the majority of the membership. You do not have to own a telescope in order to be a member.

Those renewing their club membership are encouraged to do so by using the online application before the end of December. Normally our memberships are only good for the calendar year, but anyone joining after October 1st will be given a membership for the remainder of 2019 and all of 2020. The regular club membership remains a bargain at \$30.

Student membership (full-time High School or College student) is only \$10! Alternatively, Patron Membership, which grants use of the club's 17.5" reflector at H2O, is available at the annual rate of \$100.00. To become a key holder to H2O, you must be 18 or older. There is a one-time \$20 Key deposit and a \$10 annual access fee.

You can join TVS or renew your membership online at:

<http://www.trivalleystargazers.org/membership.shtml> After filling out the application form you are connected to the PayPal payment form. You do not need to have a PayPal account to pay online, since PayPal will accept credit cards. Everyone is encouraged to use the online application. 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.

Calendar of Events

November 13, 7:00pm

What: Meet the Neighbors: Planetary Systems Orbiting Nearby Stars

Who: Dr. Courtney Dressing, UC Berkeley

Where: Foothill College, Smithwick Theatre, 12345 El Monte Road, Los Altos Hills, CA 94022

Cost: Free, \$3 parking (Credit Cards or \$1 dollar bills)

No details available.

For more information see: <https://foothill.edu/astronomy/> or phone 650-949-7888.

November 19, 7:15pm

What: Those Magnificent Images: Ask the Experts

Who: MDAS Imaging Group

Where: Mt. Diablo Astronomical Society, Lindsay Wildlife Experience, Community Room, 1931 First St., Walnut Creek, CA 94597

Cost: Free.

Experts will share their astroimages and provide tips on how to obtain them.

For more information see: https://nightsky.jpl.nasa.gov/event-view.cfm?Event_ID=95253

Header Image: Meteorite North West Africa 869-Ordinary L5 Chondrite about 1-inch in size. Metal grains and chondrules are visible. Credit: Ken Sperber

Calendar of Events (continued)

November 19, 7:30pm-10:00pm

What: Imaging Meeting
 Who: Bruce B.
 Where: Houge Park, 3972 Twilight Drive, San Jose, CA
 Cost: Free

The Imaging SIG meets roughly every month at Houge Park to discuss topics about imaging. The SIG is open to people with absolutely no experience but want to learn what it's all about, but experienced imagers are also more than welcome, indeed, encouraged to participate.

For more information, see: <https://www.meetup.com/SJ-Astronomy/events/lkxnnmyzpbzb/>

November 20, 4:00pm-5:00pm

What: The Century of Biology on Earth and Beyond
 Who: Jill Tarter, SETI Institute
 Where: Los Gatos Library
 Cost: Free

Are we alone? We want to know whether there is life beyond Earth and whether any of it is intelligent. Since the middle of the twentieth century, we have had astronomical tools that permit us to embark on a scientific exploration to try to answer this age-old question. Join Dr. Jill Tarter of the SETI Institute to learn about our search for extraterrestrial intelligence.

For more information see: <http://www.seti.org/talks>, and <https://www.losgatosca.gov/42/Los-Gatos-Library>

November 20, 7:00pm-8:00pm

What: Technosignatures vs. Biosignatures: Which Will Succeed First?
 Who: Jill Tarter and Vikki Meadows, SETI Institute

Where: SRI Conference Center, 333 Ravenswood Ave., Menlo Park, CA 94205 (Enter from Middlefield Rd.)
 Cost: Free, Registration Required-Open Nov. 6

The discovery that exoplanets are common has radically changed our view of the universe. The likelihood that there are habitable worlds elsewhere in the universe seems more plausible than ever before. Astronomers, including Vikki Meadows, are developing new instruments to help search for life on other planets. By analyzing data from exoplanets and identifying biosignatures, we will be able to search for habitable planets and the presence of life.

Which approach will discover the first evidence of extraterrestrial life? Will technosignatures or biosignatures confirm our hypothesis that life exists outside our watery, shimmering planet and that, indeed, we are not alone?

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

December 2, 7:30pm

What: Humpback Whale Song as an Intelligence Filter for SETI
 Who: Dr. Laurance Doyle, SETI Institute
 Where: California Academy of Sciences, 55 Music Concourse Dr., Golden Gate Park, San Francisco, CA
 Cost: Advanced ticketing required. Academy members \$12, Seniors \$12, General \$15. Reserve a space online or call 1-877-227-1831.

We have been applying the mathematics of information theory—originally developed for human communication systems and computers—to humpback whales in order to measure the complexity of their vocalizations. Is their “language”

continued on p.4

Officers	Volunteer Positions	Night Sky Network Rep.: Ross Gaunt nnsn@trivalleystargazers.org	Refreshment Coordinator: Laurie Grefsheim
President: Roland Albers president@trivalleystargazers.org	Astronomical League Rep.: Dennis Beckley alrep@trivalleystargazers.org	Newsletter Editor: Ken Sperber newsletter@trivalleystargazers.org 925-361-7435	Webmaster: Hilary Jones webmaster@trivalleystargazers.org
Vice-President: Eric Dueltgen vice_president@trivalleystargazers.org	Club Star Party Coordinator: Eric Dueltgen coordinator@trivalleystargazers.org	Observatory Director/Key Master: Chuck Grant observatory@trivalleystargazers.org	Web & E-mail www.trivalleystargazers.org info@trivalleystargazers.org
Treasurer: David Feindel treasurer@trivalleystargazers.org	Del Valle Coordinator: David Feindel delvalle@trivalleystargazers.org	Outreach Coordinator: Eric Dueltgen outreach@trivalleystargazers.org	TVS E-Group To join the TVS e-group just send an e-mail message to the TVS e-mail address (info@trivalleystargazers.org) asking to join the group. Make sure you specify the e-mail address you want to use to read and post to the group.
Secretary: Ron Kane secretary@trivalleystargazers.org	Historian: Hilary Jones historian@trivalleystargazers.org	Potluck Coordinator: Jill Evanko potluck@trivalleystargazers.org	
Past President: Rich Combs past_president@trivalleystargazers.org	Internat. Dark-Sky Assoc. Rep.: Aadi Duggal darksky@trivalleystargazers.org	Program Coordinator: Dan Helmer programs@trivalleystargazers.org	
	Librarian: Ron Kane librarian@trivalleystargazers.org	Publicity Coordinator: Jim Theberge publicity@trivalleystargazers.org	
	Loaner Scope Manager: Ron Kane telescopes@trivalleystargazers.org		

Calendar of Events (continued)

as complex as ours, or even more complex? Are there general rules for communicating knowledge that even messages from extraterrestrial intelligence (ETI) will have to obey?

As astrobiology uses Antarctica as a proxy for Mars, so we are using non-human but complex communication systems as a proxy for an ETI signal if and when one may be received. Humpback whales grew up on the same planet, and around the same star, as humans did, but their communication systems are certainly not human! Thus we can deprovincialize our thinking and approach to the detection of intelligent life in space.

For lecture and reservation information see <https://www.calacademy.org/events/benjamin-dean-astronomy-lectures/humpback-whale-song-as-an-intelligence-filter-for-seti>

December 27-28, 6:00pm - 9:00am

What: Slumber With the Stars: 60 Year of the Twilight Zone

Who: Staff

Where: Chabot Space and Science Center, 10000 Skyline Blvd., Oakland, CA 94619

Cost: Adults 21+ Only; Members \$90, General \$95

It's the 60th anniversary of the Twilight Zone, and we're inviting you to unlock this door with the key of imagination. Come dressed as characters from your favorite episode. Your night will feature viewings of a few of the best episodes of all time. You'll enjoy delicious recipes made directly from the remarkable cookbook "To Serve Man," drinks in the "Nick of Time" at the "Busy Bee Café", access to Chabot's rarely open library, or should we say, the secret Henry Bemis reading room.

Your adventure includes a Planetarium show, exhibits, showing of Twilight Zone episodes, Trivia, and telescope viewing-weather permitting. Also included is dinner and a continental breakfast, including vegetarian options. Each guest will receive two drink tickets for beer, wine or non-acholic beverages. Additional drinks are available for \$8.00.

Bring your own sleeping bags, mats, toiletries, jacket, medications, water bottle, snacks, tents (optional for outdoor sleeping).

For more information see: <https://14884.blackbaudhosting.com/14884/Slumber-with-the-Stars-Twilight-Zone-Sleepover-21> or call (510) 336-7373.

TVS Outreach Report



Image Caption: Jenny Siders took this image of Zane at the eyepiece of Lance Simms' telescope during the TVS Outreach event at Altamonte Creek School on October 30. Lance noted that "Zane was extremely enthusiastic. He did a great job of helping me align the telescope and reminding other students not to touch it. Having helpers like him is pretty nice."

TVS Member Astrophotos



Image Caption: Last month, Andy Coutant took this image of the Milky Way above the snowy peaks of the Sangre De Cristo Mountains from Westcliffe, CO, an International Dark Sky Town.



Image Captions: While attending the Antique Telescope Society Meeting this past October, Gert Gottschalk took these two images at New Mexico Sky Village: Left: The Dragonfly Telescope is operated by Prof. Roberto Abraham and colleagues from the Dunlap Institute for Astronomy and Astrophysics of University of Toronto. Its distinctive feature is the use of 24 commercial 400mm F2.8 telephoto lenses to image very low contrast objects in the universe. Right: The 95cm Boller & Chivens telescope, formerly of Princeton University, is being restored.

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

All times are Pacific Standard Time

November

- 11 Mon Mercury transit of the Sun. USE PROPER EYE PROTECTION! (Sunrise - 10:03am)
- 12 Tue **Full Moon (5:34am)**
- 16 Sat The Moon rises in Gemini, $\sim 6^\circ$ right of Pollux (Evening)
- 16-17 Sat The Leonid Meteor Shower peaks, but the waning Moon interferes (All Night)
- 19 Tue **Last-Quarter Moon (1:11pm)**
- 23-24 Sat- Venus and Jupiter are separated by $\sim 1^\circ$ (Dusk)
- 25 Mon Mars, Mercury, and the Moon form a line 10° long (Dawn)
- 27-30 Wed- The Moon passes Venus and then Saturn, with Jupiter closest to the Horizon (Dusk)

December

- 1 Sun Mercury and Mars near the southeast horizon (Dawn)
- 1 Sun Saturn, Venus, and Jupiter extend 18° above the southwest horizon (Dusk)
- 3 Tue **First-Quarter Moon (10:58pm)**
- 4 Wed Algol at minimum brightness for ~ 2 hours centered on 7:18pm
- 10 Tue Venus and Saturn less than 2° apart in the southwest (Dusk and Evening)
- 11 Wed **Full Moon (9:12pm)**
- 12 Thu Mars less than 0.25° from double star Alpha Librae (Dawn)
- 13-14 Fri The Geminid Meteor Shower peaks, but the waning Moon interferes (All Night)
- 17 Tue The Moon is about 3° from Regulus in Leo (Morning)
- 18 Wed **Last-Quarter Moon (8:57pm)**
- 20 Fri The Moon is about 10° from Spica and 5° from Porrima (Morning)
- 21 Sat The longest night of the year in the Northern Hemisphere. The winter Solstice arrives at 8:19pm
- 24 Tue Algol at minimum brightness for ~ 2 hours centered on 9:02pm
- 25 Wed **New Moon (9:13pm)**

NASA Night Sky Notes

The Messenger Crosses the Sun: Mercury Transit 2019

By David Prosper

Did you know that there are two other objects in our skies that have phases like the Moon? They're the inner planets, found between Earth and the Sun: Mercury and Venus. You can see their phases if you observe them through a telescope. Like our Moon, you can't see the planets in their "new" phase, unless they are lined up perfectly between us Earthlings and the Sun. In the case of the Moon, this alignment results in a solar eclipse; in the case of Mercury and Venus, this results in a transit, where the small disc of the planet travels across the face of the Sun. Skywatchers are in for a treat this month, as Mercury transits the Sun the morning of November 11!



You may have seen the transit of Venus in 2012; you may have even watched it through eclipse glasses! However, this time you'll need a solar telescope to see anything, since eclipse glasses will only reveal the Sun's blank face. Why is that? Mercury is the smallest planet in our solar system, and closer to the Sun (and further away from Earth) during its transit than Venus was in its 2012 transit. This makes Mercury's disc too small to see without the extra power of a telescope. Make absolutely certain that you view the transit via a telescope equipped with a safe solar filter or projection setup. Do NOT combine binoculars with your eclipse glasses; this will instantly burn a hole through the glasses – and your eyes! While most people don't have solar telescopes handy, many astronomy clubs do! Look for clubs hosting Mercury transit observing events near you at bit.ly/findnsn (USA) or at bit.ly/awbtransit (worldwide).

What a fun opportunity to see another planet during the day! This transit is expected to last over five hours. Folks on the East Coast will be able to watch the entire transit, weather permitting, from approximately 7:35am EST until around approximately 1:04pm EST. Folks located in the middle of North America to the west coast will see the transit already in progress at sunrise. The transit takes hours, so if your weather is cloudy, don't despair; there will be plenty of time for skies to clear! You can find timing details and charts via eclipse guru Fred Espenak's website: bit.ly/mercurytransit2019

Mercury's orbit is small and swift, and so its position in our skies quickly changes; that's why it was named after the fleet-footed messenger god of Roman mythology. In fact, if you have a clear view of the eastern horizon, you'll be able

to catch Mercury again this month! Look for it before dawn during the last week of November, just above the eastern horizon and below red Mars. Wake up early the morning of November 24th to see Mars, the Moon, and Mercury form a loose triangle right before sunrise.

Discover more about Mercury and the rest of our solar system at nasa.gov

This article is distributed by the NASA Night Sky Network, a coalition of hundreds of astronomy clubs across the US dedicated to astronomy outreach. Visit nightsky.jpl.nasa.gov to find local clubs, events, stargazing info and more.

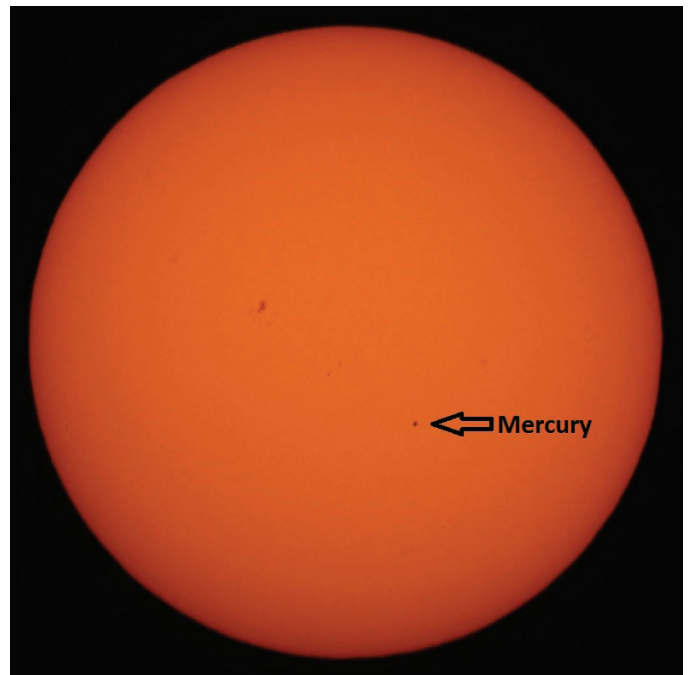


Photo of the May 9, 2016 transit of Mercury. Mercury is the small dot on the center right. Note how tiny it is, even compared to the small sunspot on the center left. Credit: Dave Huntz Label and Arrow added by K. Sperber



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

Tri-Valley Stargazers Membership Application

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 (\$10). 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): Must be 18 or older.

_____ 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.

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 except as detailed in our Privacy Policy (<http://www.trivalleystargazers.org/privacy.shtml>).

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