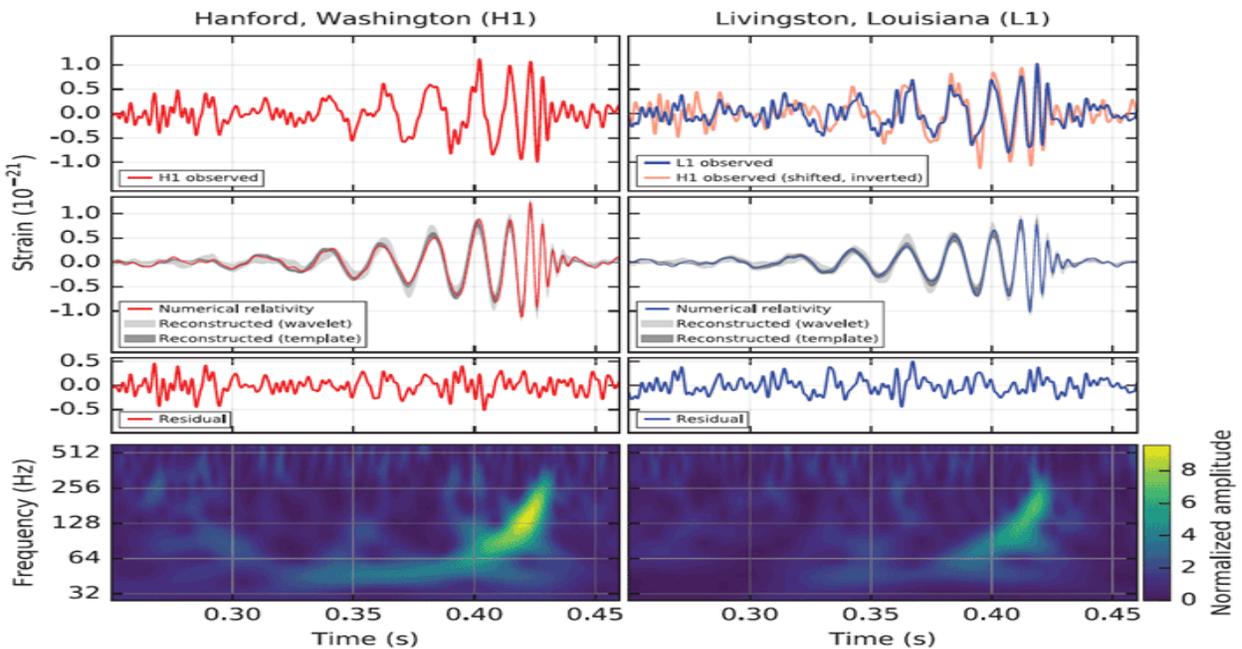


Newsletter of the Baton Rouge Astronomical Society



March, 2016

Next Meeting: Monday, March 14th at 7PM at HRPO



Hopefully you learned about the big news from LIGO. If not, click on the image to get the scoop!

What's In This Issue?

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Astro Short: Drying Out the Moon?

Message from the HRPO

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20/20 Vision Campaign

International Astronomy Day



Secretary's Summary of February Meeting

- John started off by announcing that the recent outreach at the Westdale Middle STEM program went well. He introduced Don Weinell who spoke about the recent trip to Rockefeller. He said there was more birdwatching than stargazing, but that it looked like everyone there had a good time. There were 9 adults and 2 kids that attended; Don invited everyone to plan on doing it next year. Craig later in the meeting thanked Don for doing all the work to make the Rockefeller event happen and talked about the facilities there. Don reminded everyone about the Hodges Gardens Star Party coming up in April (6th – 10th).
- Don also announced that we are having “Amateur Night” next month instead of a guest speaker. Any BRAS member that wants to speak on an astronomy-related topic for 10 to 15 minutes for this event needs to talk to Don about it. He’s looking for 3 to 5 presentations to fill the time period. So far, Chris Desselles wants to talk about cataract surgery for astronomers, Wally wants to talk about cleaning mirrors, and Craig wants to discuss eyepiece cleaning.
- Outreach is still looking for volunteers to help out with science demos at Friendship High School on Feb. 11th from 6 – 7 pm, a program at Copper Mill in Zachary on Feb. 26th from sundown – 8:30 pm, and at St. Michael’s for a Cub Scout banquet on Feb 27th. There is the annual Rocking at the Swamp (Bluebonnet Swamp) on March 19th. It’s also the 35th anniversary for BRAS this year; the question was raised to the group as to whether or not there was any interest in celebrating the occasion.
- John had received correspondence from Richard Schmude from the Southeast Region of the Astronomical League who is trying to get a regional meeting set up. This will probably showcase workshops and papers with dark sky viewing.
- Non-Messier and double-star marathons in Astronomy’s March issue were noted.
- Under “new business” Brad told us that Thursday morning LIGO may announce something major. LSU is planning a related open house event at 130 Nicholson Hall at the same time.
- Don announced a human fatality by meteorite.
- Dr. Brad Schaefer presented an interesting lecture on Tabby’s Star (“KIC 8462852 Is Not a Dyson Sphere Or...?”). This was a discussion about what could be causing a star in the Cygnus constellation to fade by about 20% at one point.
- Chris announced that Dr. Amber Stuver from LIGO was the scheduled lecturer for Feb 19th at the Observatory. He let everyone know that there was a formalized badge process for BREC volunteers now; a discussion on background checks followed. He also announced that the 2015 winner of the Frank Conrad Volunteer of the Year Award was John Nagle.
- John announced that he had info in case anyone wanted to sign up for outreach.
- Craig announced that he was collecting 2015 dues since Trey was not there.
- There was a raffle for three books at the end of the meeting.

Roslyn Readinger
BRAS Substitute Secretary

(Thanks for filling in for me, Ros!!)

Drying Out the Moon?

For decades, planetary scientists and geologists assumed that the Moon was about the driest and dustiest place in the solar system. Then around 2010, a spate of independent observations from spacecraft and elsewhere uncovered evidence of hydrogen in lunar rocks. Taking hydrogen as a proxy for water (H₂O), the evidence suggested that ice might be buried at the lunar poles—and that indeed, the material from which the Moon formed might have been as wet as that which formed Earth.

The lunar mineral richest in hydrogen is apatite: a compound of calcium, phosphorus, and oxygen that also incorporates either fluorine, chlorine, or hydroxyl (an oxygen-hydrogen group). For those who like chemical formulas, apatite is written as Ca₅(PO₄)₃(F, Cl, OH).

Apatite is attractive as a tracer of volatile elements in many environments because it appears in many rocks brought back by the *Apollo* astronauts, ranging from the relatively young lunar maria (lava seas) to the ancient highlands. Thus, apatite was regarded as a good tracer of hydrogen. Indeed, apatite was the *only* hydrous mineral (one with water or water's constituents) in lunar samples.

A new computational model of how apatite crystalizes, devised by Jeremy W. Boyce in the Department of Earth, Planetary, and Space Sciences at UC Los Angeles and four coauthors now indicates that apatite is a misleading indicator of water in the Moon.

No appetite for apatite

Boyce's model simulates how apatite crystalizes out of cooling molten lunar magma, incorporating fluorine, chlorine, or hydrogen into its structure. Modeling revealed that during fractional crystallization—in which newly formed crystals separate from the melt—apatite preferentially incorporates fluorine first.

“Early-forming apatite is so fluorine-rich that it vacuums all the fluorine out of the magma, followed by chlorine,” explained Boyce. “Apatite forming later doesn't see fluorine or chlorine and becomes hydrogen-rich because it has no choice.”

The model also makes specific testable predictions. For example, it predicts that apatite crystals grown at different times in the same magma should have different abundances of fluorine, chlorine, and hydrogen—abundance differences observed almost ubiquitously in lunar rocks. It also suggests that if crystallization is quick or diffusion slow, the core of a crystal should be rich in fluorine while its rim is fluorine-poor and hydrogen rich—zoning indeed observed in basalts brought back from *Apollo* missions 11, 12, and 14.

Most importantly, the model demonstrates how apatite could form with orders of magnitude more hydrogen than expected from a melt actually having little water. “Because it is not required that late stage H₂O_{melt} [the amount of water in the melt] be elevated in order to explain the elevated abundances of H₂O_{ap} [the amount of water in the apatite], hydrogen-rich apatite cannot be cited as evidence for elevated H₂O_{melt} a priori,” state Boyce and his co-authors in their paper in the April 25, 2014 issue of *Science*.

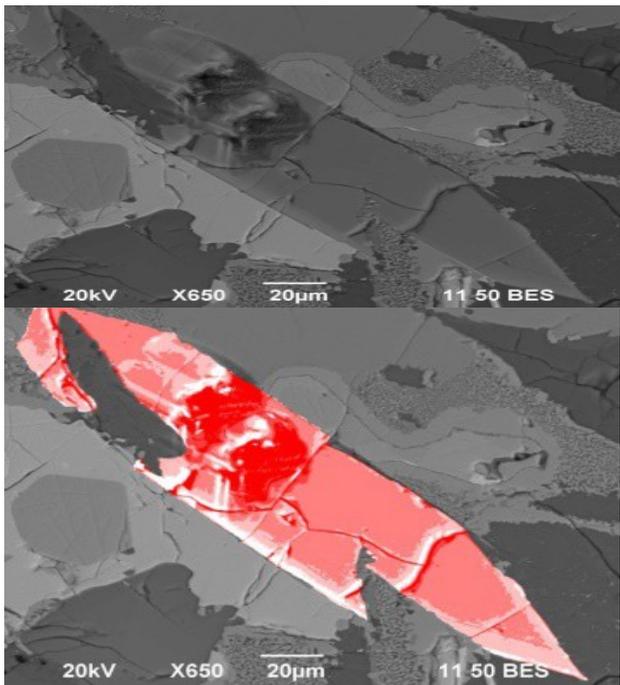
So does the Moon have water?

Does this finding about apatite mean the Moon is as arid as thought before about 2010? Likely, no, says commentator Mahesh Anand in a perspective article in the same issue of *Science*. Olivine crystals, “which were some of the earliest-formed crystals in lunar volcanic glasses, point to a wet lunar interior,” Anand pointed out, as does spectroscopic analysis of plagioclase crystals and other observations

What the finding does mean is that apatite—the most widely used method for estimating water in lunar rocks—“cannot be trusted,” Boyce declared.

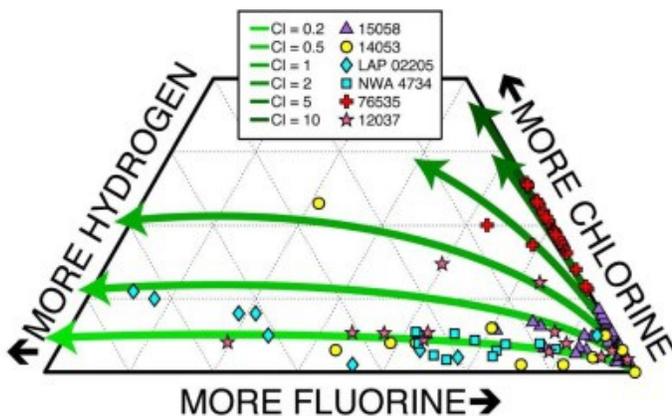
“We're knocking out one of the most important pillars of evidence regarding the conditions of the

formation and evolution of the Moon,” he concluded. “Next, we plan to determine how badly apatite has distorted our view of the Moon and how we can best see past it to get at the Moon’s origin.” – *Trudy E. Bell, M.A.*



Photomicrograph of Apollo 11 lunar sample

10044,644 maps density of its polished surface: denser materials reflect more electrons and look lighter gray. Pinkscale version of image highlights density variations for a crystal of apatite. Such variations would be expected had the crystal formed through fractional crystallization—a process that ruins apatite’s ability to record volatiles, including hydrogen. Credit: Jeremy Boyce, UCLA



Measurements of hydrogen, fluorine, and chlorine in different lunar samples are shown as different symbols. Green curves represent how composition of apatite changes because of fractional crystallization. Shades of green depict models with different amounts of Cl, but all models have identical water. Changing the amount of fractional crystallization and the Cl content, one can model any apatite found now on the Moon, whether water rich or water poor—but all could have come from magmas with the same water content. Thus, apatite is a poor indicator of magmatic water. Credit: Jeremy Boyce, UCLA

HRPO

FRIDAY NIGHT LECTURE SERIES

all start at 7:30pm

4 March: “The Chinese Calendar” Professor John Henderson returns for his information presentation of a lunisolar calendar traditionally used by hundreds of millions.

18 March: “Juno to Jupiter” The most massive object in the Solar System aside from the Sun, yet it makes one complete rotation in less than ten Earth hours! And now, after almost five years of travel, a spacecraft sent from Earth will investigate it!

25 March: “Dating the Crucifixion” It is one of the most profound events to influence Western history. Can ancient texts and the motions of the Universe help pinpoint the actual date? For the *tenth* consecutive year, LSU physics professor Brad Schaefer returns for Good Friday and leads the audience step-by-step through the investigation in this, one of the most intriguing lectures in HRPO history!

SCIENCE ACADEMY

Saturdays from 10am to 12pm

For ages eight to twelve. \$5/\$6 per child.

5 March: “Deep Space Objects I”

12 March: “Deep Space Objects II”

19 March: “Expedition 6”

26 March: “Names and Catalogs”

SOLAR VIEWING

For all ages. Free admission.

26 March, 12pm to 2pm

CALL FOR VOLUNTEERS

*Saturday, 19 March from 7pm to 10pm. *Three volunteers.* **Evening Sky Viewing Plus.** Various tasks. Easy; training provided.

*Saturday, 14 May from 3pm to 11pm. *Fifteen to twenty volunteers.* **International Astronomy Day.** Various tasks. Moderately difficult.

***Monday, 9 May from 6am to 2pm. Six volunteers familiar with at least one telescope. Transit of Mercury. Solar viewing. Moderately difficult.**

Recent Entries in the Forum

Below are selected recent additions to the BRAS Forum. There are also [nine active polls](#).

Wreath-Laying Ceremony for NASA [Day of Remembrance](#)

Former BREC Superintendent [Mark Thornton](#) Passes Away

[Space Tourism Posters](#) from JPL!

[FY2017 NASA Budget Estimates](#) Released

Do We Really Know [How Dense Saturn's Rings Are?](#)

March [Great Red Spot Viewing Times](#) to be Posted on Monday

Science Experiments Announced for [SLS Exploration Mission 1](#)

[Mars' Magnitude](#) Exceeds +0.5

[Lunar Halo](#) Returns for Winter

At Least [Eight Geomagnetic Storm Alerts](#) in February

[Daylight Time](#) Returns

[Dimishing Asteroid Dilemma](#) May Have Answer

BRAS Member Assists in [Investigation of "Asteroid"](#)

LIGO Proves [Existence of Gravitational Waves](#)

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[20/20 Vision Campaign](#)

[GLOBE at Night: 1 March to 10 March](#)

2016 GOAL: 200 Measurements. CURRENT: 27

BRAS is in the process of assisting a student at St. Joseph's Academy acquire raw data. The student needs descriptions of views of five Messier objects—Pleiades, Orion Nebula, Andromeda Galaxy, Beehive Cluster, Whirlpool Galaxy—together with that location and date's GaN measurement. An alert will be sent out describing this exercise in more details. The student needs very much this information with *at least three sky views (different limiting magnitudes)*.

BRAS gave input on 25 February during the [I-10 Corridor Improvement Study Meeting](#) at the Marriott, speaking to an employee from DOTD and leaving a written statement.

The [Atchafalaya Trace Commission](#) meets on 2 March.

INTERNATIONAL ASTRONOMY DAY

Saturday, 14 May from 3pm to 11pm

Tenth Consecutive Year!

Volunteers needed!

RAFFLE TICKETS, \$5 EACH

First Prize: Orion 40th Anniversary Skyquest XT8 Dobsonian Telescope

Value: \$499.99

SOME RETURNING EXHIBITORS...

Baton Rouge Amateur Radio Club

Baton Rouge Metropolitan Airport

Baton Rouge Zoo

Bluebonnet Swamp Nature Center

Civil Air Patrol

LIGO

Saint Joseph's Academy

NEW EXHIBITORS...

Baton Rouge Gallery

Baton Rouge Mosquito Abatement

MARS Van

RIDES...

18" Dry Slide

Spacewalk

Obstacle Course

OTHER...

Adventure Quest

Face Painting

Homemade Comet

Scope-on-a-Rope

Train Like an Astronaut

Early volunteer sign-up is needed. It is extremely difficult to schedule a volunteer if that person reveals his availability with only two or three days to go. Sign-up now, please!