The Grail mission's gravity map of the Moon. The mission ended last week when the two probes Ebb and Flow were deliberately crashed into the surface.

The latest Dark Sky map of the USA. See Birch's fav spot in west Texas?

**Longmont Astronomy Society Newsletter**
**December 2012**
From the President:
No meeting this month, FRCC is closed for Christmas and New Year vacations.

January meeting will probably be on Sunday, January 20th. Location, etc is not yet determined. Details will be announced in the next week or two. There will be elections for the 2013 officers at that meeting. All officer positions are open each year --- president, vice president, treasurer, newsletter editor, ALCOR, webmaster. Please consider volunteering a bit of your time and help support LAS in the coming year.

Upcoming star parties:

Islamic Center of Boulder, 55th and Baseline is on Friday Dec. 19th. Dinner at 6, star party begins at 6:30 pm.

Carrie Martin Elementary, Loveland is on Fri, Feb 1st 5:30 to 7 pm.

In the sky this month:
Meteor Showers – The Geminis were decent, and you can look at some pictures on spaceweather. The next meteor shower is the Quadrantids on the night of January 3. With the Moon setting at midnight, visibility should be good.

Like this beautiful view of the Geminids taken by Jeff Dai, Yunan Province in China and swiped from Spaceweather.
**Planets: data is December 20**

- **Mercury**: rises an hour before the Sun, low in the East
- **Venus**: rises an hour and a half before the Sun, low in the East and fading/falling fast
- **Mars**: sets 2 hours after the Sun, low in the West
- **Jupiter**: still pretty much high in the South at midnight and the pride of the night sky
- **Saturn**: rising 4 hours before the Sun, its getting better for a spring look.

**Current Extra-solar Planet count**: Last update: Dec. 18, 2012 (854 planets)

It's been an exciting few weeks at Galaxy Zoo, with two particularly cherished scientific results being accepted by the journals, thanks to all the hard work you've provided via [GalaxyZoo.org](http://GalaxyZoo.org).

The first is a study of mysteriously bulgeless galaxies. These spirals, which lack the normal 'bulge' of stars you see at the centre of most such galaxies, including the Milky Way, are guaranteed (we think!) never to have had a merger. They can uniquely tell us about the effect dramatic mergers have on galaxies unfortunate enough to endure them - the ones highlighted in this recent paper have surprisingly large black holes, which must have grown in this unique merger free environment.

Bulgeless galaxies are a new departure for us, but the other paper is a study of some of our oldest finds. Bill Keel and team - including a whole host of Galaxy Zoo users - are proud to publish the official Galaxy Zoo catalogue of 1990 overlapping galaxy pairs. Before we started, only 20 of these unique systems were known so this is a huge advance. Congratulations to all, particularly the dedicated denizens of the forums who tracked them all down.

If you haven't had enough galaxies, then we'd also like to invite you to take a close look at the large system nearest to home. [Andromedaproject.org](http://Andromedaproject.org) is the latest Zooniverse project, and it aims to create a unique catalogue of star clusters in the Andromeda Galaxy. There are also a few more distant galaxies lurking in these stunning Hubble Space Telescope images, waiting to be discovered. Please do go and try it out.

Dear Planet Hunters,

We launched the project at this time two years ago. We've had over 15.6 million classifications by more than 200,000 people worldwide. Thanks to all of your classifications and help Planet Hunters has produced 3 accepted and published research papers, discovered new planet candidates, and found our first confirmed planet, PH1 (which also happens to be the first planet in a four star system). We couldn't do this work without...
all of you. Thank you for all the time and effort you put into Planet Hunters.

To mark Planet Hunters' 2nd birthday, we hosted a live chat with members of the Science Team. In case you missed it, you can find the video recording on our blog at http://blog.planethunters.org/2012/12/12/live-chat-at-3pm-gmt-today/.

As we start year 3, Kepler has also begun its extended mission, and there will be much more data coming in 2013 that we'll need your help to search for transits in. In the coming year, you’ll see changes to the site as we adapt and change in the extended mission. We can’t wait to see what is waiting in the light curves for the Planet Hunters community to find in this next phase.

Help us celebrate Planet Hunters’ 2nd Birthday by classifying some light curves today at http://www.planethunters.org/

Happy Hunting,

Meg and the Planet Hunters Team

**Club Calendar:**
S'posed to be a January banquet someplace in there – stay tuned.
Science Fair at Carrie Martin Elementary NW of Berthoud on Feb 1.

**Fiske Planetarium:** closed for remodeling until fall 2013

**Internet Resources:**
http://www.youtube.com/watch?v=_xY1_v-bTVU The CoCoRAHS powerPoint on remote sensing (how weather satellites work) If you like the weather bit, there are more videos available at that site. You can sign up for daily weather reporting duties and buy your official $20 rain / snow gauge at cocorahs.org Join the editor and over 10,000 daily precipitation reporters – their goal is one reporter per square mile! You can go out like one reporter in a hurricane and record over 30 inches of rain, or join another in the Sierra Nevada that had 250+ inches of snow on the ground last May.

Second biggest Black hole: You would probably not enjoy the galaxy NGC 1277. Never mind that it's far - 220 million light-years away in the constellation Perseus. The problem is that at its center is a giant, giant black hole, 17 billion times as massive as our sun, so big that scientists calculate it makes up 59 percent of the mass of the galaxy's disc.

Astrophysicists have long believed that there's a black hole at the center of our Milky Way, but it probably accounts for something like 0.1 percent of the galaxy's center at a measly 3 million solar masses. The one in NGC 1277, scientists report in today's edition of the journal Nature, is the second largest they've ever observed, and it upends what they thought about how galaxies form.
Black holes, as you'll recall, are objects in space so massive that their gravity consumes everything around them - stars, planets, matter, energy, even light. Earthly scientists can only observe their effect on the space around them, not see them directly. Be grateful we're not close to one. They're actually useful to astrophysicists in explaining the nice spiral shape of many galaxies - you need something massive in the middle for the stars to circle - but NGC 1277 is an extreme.

"This is a really oddball galaxy," said Karl Gebhardt of the University of Texas at Austin, a member of the team that made the find. "It's almost all black hole. This could be the first object in a new class of galaxy-black hole systems." Gebhardt and colleagues at the McDonald Observatory have been calculating the mass of different black holes - no small task considering their powerful gravity.

Life at Extremes:

Nov. 30, 2012: Nearly 65 feet beneath the icy surface of a remote Antarctic lake, scientists from NASA, the Desert Research Institute (DRI) in Reno, Nev., the University of Illinois at Chicago, and nine other institutions, have uncovered a community of bacteria existing in one of Earth's darkest, saltiest and coldest habitats.

Lake Vida, the largest of several unique lakes found in the McMurdo Dry Valleys, contains no oxygen, is mostly frozen and possesses the highest nitrous oxide levels of any natural water body on Earth. A briny liquid, which is approximately six times saltier than seawater, percolates throughout the icy environment where the average temperature is minus 8 degrees Fahrenheit. The international team of scientists published their findings online Nov. 26, in the Proceedings of the National Academy of Sciences Early Edition.

Upcoming Space Missions:
Ball Aerospace has been selected to build the TEMPO mission spacecraft to measure air pollutants. Read all the upcoming mission details and plans at http://www.nasa.gov/centers/langley/science/TEMPO.html

**Current Space Missions:**

NASA's Voyager 1 spacecraft has discovered a new layer of the solar system that scientists hadn't known was there, researchers announced today (Dec. 3).

Voyager 1 and its sister probe Voyager 2 have been traveling through space since 1977, and are close to becoming the first manmade objects to leave the solar system.

Scientists haven't been sure exactly when that exit would occur, and now say the spacecraft are likely in the outermost region of the solar system, which is defined by the extent of the heliosphere, the large bubble of charged particles the sun puffs out around itself. Voyager 1, in particular, has entered a new region of the heliosphere that scientists are calling a "magnetic highway," which allows charged particles from inside the heliosphere to flow outward, and particles from the galaxy outside to come in.

"We do believe this may be the very last layer between us and interstellar space," Edward Stone, Voyager project scientist based at the California Institute of Technology, in Pasadena, Calif., said during a teleconference with reporters. "This region was not anticipated, was not predicted."

Therefore, he said, it's hard to predict how soon Voyager will leave the solar system behind altogether. [How NASA's Voyager 1 and 2 Probes Work (Infographic)]

"We don't know exactly how long it will take," Stone said. "It may take two months, it may take two years."

The scientists don't think the Voyagers have left the solar system yet because of the orientation of the magnetic field they detect. So far, this field still runs east-west, in agreement with the field created by the sun and twisted by its rotation. Outside the solar system, models predict the magnetic field to be orientated more north-south. (I know that you always wanted to know that, didn't you?)

Grail Mission:
Grail's Moon view: Reds correspond to mass excesses which create areas of higher local gravity, and blues correspond to mass deficits which create areas of lower local gravity.

The scale of the battering the Moon received early in its history has been revealed in remarkable new data from two Nasa satellites.

Ebb and Flow - together known as the Grail mission - have mapped the subtle variations in gravity across the surface of the lunar body.

They show the Moon's crust to be a mass of pulverised rock - the remains of countless impacts.

Scientists say the beating was far more extensive than previously thought.

And this observation, they add, has relevance for the study of the Earth's ancient past.

It too would have been pummelled in the first billion years of its existence by the left-over debris from the construction of the planets.

Also see the Front Cover of this month's newsletter. I was unable to locate the mission image website.

The other Front Cover: [http://npp.gsfc.nasa.gov/index.html](http://npp.gsfc.nasa.gov/index.html) homepage for the suomi npp satellite that took the newest “USA at night” picture

Curiosity at Mars: image archive is at [http://www.jpl.nasa.gov/msl/](http://www.jpl.nasa.gov/msl/) As the mission continues, the pictures get better and better. And we thought Spirit and Opportunity were doing pretty good!

**This month's Wacky Idea:**

It had to happen: A start-up company is offering rides to the moon. Book your seat now — though it’s going to set you back $750 million (it’s unclear if that includes baggage fees).
Led by heavy-hitter former NASA executives, the Golden Spike Co. would boldly go where humankind went 40 years ago, this time commercially, hawking tickets to foreign governments or space tourists.

**Humor Dept:**

Q: How many astronomers does it take to change a light bulb?

1) Ten! One to change the bulb, and nine to argue how their own bulb gives better colour.

2) None! Astronomers aren't afraid of the dark.

3) See the FAQs.

"What sort of light bulb should I buy?"
"Should I start with a candle?"
"Where should I buy my light bulb?"
"Where NOT to buy a light bulb."
"What type of light bulb to avoid?"
"What will I be able to see with my bulb?"
"How do I deal with telescope-pollution?"
"Can I buy a bulb for a friend?"
"Can I use my bulb in the daytime?"

And a Bumper crop of imaging from Gary Garzone: 

Red Spot Transit on Jupiter
Pac Man Nebula

M51 Whirlpool Galaxy