# AOH Newsletter <br> Spring 2020 

## News and Notes

## Outreach Heroes.

Among the purposes of our organization, as enumerated in the Bylaws, are "To promote interest in, and advance knowledge in, the science of astronomy, optics, and related subjects; To support, organize, promote and/or present astronomical themed community events that will enhance such knowledge in the Humboldt Bay Region; To promote and support student and youth interests and education in astronomy and related subjects." That we have had some success was attested to by Dr. Tyler Mitchell, the speaker at our 2020 annual Potluck in February, who said "Born and raised in Humboldt County, my interest in Astronomy was first sparked as a child at an Astronomers of Humboldt event at the Kneeland Airport." We hope to continue our efforts in the present day through our Outreach Program, where our volunteers interact with the public, adults and youth, using our telescopes and other educational materials. At the Potluck, certificates of thanks and pins from the Night Sky Network were awarded to Bea Asmundardottir, Becky Chambers, Bernie Christen, Susie Christian, Joey D’ambra, Greg Deja, Dan Eaton, Jeff Goodman, Dean Hancock, Lisa Hockaday, Brent Howatt, Catrina Howatt. Mary Kaufman, Yoon Kim, Mark Mueller, Russell Owsley, Daniela Sanchez, Frank Simpson, John Carlton Thomas, Stormy Thomas, Donald Wheeler, Grace Wheeler, Mark Wilson, Ken Yanosko, and Bob Zigler. When you see your fellow astronomers wearing their pins, be sure to thank them for their service.

## And More Outreach.

We'll be asking for help with a number of events this summer. Plans are under way for public observing at Humboldt Redwoods State Park as well as events at schools, summer camps, and other venues. Contact catrina@astrohum.org for more information. There's a certificate and a pin waiting for you.

## Messsier Marathon.

In March, AOH members will hold the annual Messier Marathon. This is an attempt to see, in one night, as many of the deep sky objects on Charles Messier's famous list of 110 galaxies, clusters, and nebulae. See last Spring's Newsletter for a more complete description of what the marathon is, for a historical look at AOH's past marathons, and for a list of internet references. We will hold the marathon at Kneeland Airport. This year the primary weekend is Friday, March 20 or Saturday, March 21. We'll pick the day with the best weather prospects. If the weather rules out that weekend, we will pospone the event to the secondary weekend, Friday, March 27 or Saturday, March 28, again choosing the day with best forecast. The Upcoming Events page will have up-to-date information.

## Dues.

If you haven't already, don't forget to send in your 2020 dues. It's $\$ 25$ for a family membership for the calendar year. Info and address are on the Membership page.

## Thanks.

To Grace and Susan for proofreading.

## AOH Potluck

AOH members celebrated the 63rd anniversary of the founding of our club in February at the Annual Potluck held at the Humboldt Area Foundation. Twenty-six members and guests gathered to enjoy good food and companionship and raffle prizes. Awards were handed out to recognize those who participated in our outreach programs during the past year. The highlight of the evening was a presentation by Dr. Tyler Mitchell of the HSU Physics and Astronomy Department entitled "Cassini: The Golden Age of Saturn Exploration."



Counter-clockwise, from upper left, photos by: Grace Wheeler, John Carleton Thomas, Don Wheeler, John Carleton Thomas, Don Wheeler. Don Wheeler.


Photo at top middle by Ken Yanosko, others by Don Wheeler.


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# Mercury Reaches Highest Point in Evening Sky 

by Dominic Ford

As seen from Eureka, Mercury will reach its highest point in the sky in its May-June 2020 evening apparition. It will be shining brightly at mag 0.4. From Eureka, this apparition will be well placed but nonetheless tricky to observe, reaching a peak altitude of $19^{\circ}$ above the horizon at sunset on 29 May 2020. The table below lists how high above the horizon Mercury will appear at sunset over the course of its the apparition. All times are given in Eureka local time.

| Date | Sun <br> sets at | Mercury <br> sets at | Altitude <br> at sunset |
| :---: | :---: | :---: | :---: |
| 11 May 2020 | $20: 22$ | $21: 07$ | $7^{\circ}$ |

When Mercury is widely separated from the Sun, it is separated from it along the line of the ecliptic. But, at different times of year, the ecliptic meets the horizon at different angles at sunset. This would translate into Mercury being at different altitudes above the horizon, even if its separation from the Sun was constant.

If the ecliptic meets the horizon at a shallow angle, then Mercury has to be very widely separated from the Sun to appear much above the horizon. Conversely, if the ecliptic is almost perpendicular to the horizon, Mercury may appear much higher in the sky, even if it is actually much closer to the Sun.

The seasonal dependence of this is that at sunset, the ecliptic makes its steepest angle to the horizon at the spring equinox - in March in the northern hemisphere, and in September in the southern hemisphere. Conversely, it meets the horizon at its shallowest angle at the autumn equinox. Because the seasons are opposite in the northern and southern hemispheres, a good apparition of Mercury in one hemisphere will usually be badly placed in the other.

At sunrise, these dates are also inverted, so that for morning apparitions of Mercury, the ecliptic makes its steepest angle to the horizon at the autumn equinox, and its shallowest angle to the horizon at the spring equinox.


The circumstances of this event were computed using the DE405 planetary ephemeris published by the Jet Propulsion Laboratory (JPL).

## Constellations of a Lesser God <br> by Ken Yanosko

Here's a star map showing our four major midnorthern overhead springtime constellations.


At the top, you can see Ursa Major, the Big Bear, with its Big Dipper asterism. To the left is Boötes, the Herdsman, chasing the Bear, presumably away from his herd. (In cultures where the Dipper is called the "Plow" Boötes is called the "Plowman.") He hosts Arcturus ("Follow the arc"-i.e. the handle of the Big Dipper.) At the bottom of the map, to the south, is Leo the Lion, having Regulus ("the Little King") at its heart. And to the right are the twins Castor and Pollux, of Gemini. These constellations are either anchored by one or two first-magnitude stars, or, in the case of Ursa Major, have no fewer than five second-magnitude stars. Also shown on the map is Canis Minor, the Little Dog. It's not much of a dog (the astro-writer Sue French calls it a dachshund) but it does contain first-magnitude Procyon.

However, also included in this part of the sky are five other constellations which we rarely pay much attention to. (Hover over the eye icon.) When we do get a sky dark and transparent enough to see them, we usually drag out our light buckets and go for the galaxies and clusters and clouds. So here's a little reminder of what else is up there.

See the two brightest stars below the Bear's tail? They're the Hunter's Dogs, Canes Venatici, nipping at the Bear's heels. This constellation was catalogued in the 17th century, and probably misnamed. In Greek it was originally Boötes's club, but after getting translated into-and out of-Arabic it turned into a couple of dogs.

And just below the dogs is Berenice's Hair. She was a Queen of Egypt who reportedly cut off her hair in thankgiving for her husband's success in battle; the hair is represented by the constellation Coma Berenices and its open cluster Mellotte 111. In addition to this cluster, which Messier ignored-it's clearly not a comet-Coma contains about 30 NGC galaxies, 7 of which are on Messier's list.

To the right there are two bright stars above the lion's hindquarters. Don't let them distract you-they are part of Ursa Major, sometimes drawn in as the bear's other hind foot. Instead, look at the five stars to the upper right of the pair. These, with one of the dimmer ones to their upper right, form Leo Minor, the Little Lion. You must have seen those nature films where the cub is crawling all over the alpha male, who, being a terrific father, puts up with it.

Now, to the right of Leo's nose, you see two pairs of stars. The pair closest to Leo are part of his mane. The next pair over to the right are the carapace of Cancer, the Crab. Just to their right is the open cluster M44. It's called the Beehive. I don't know what a crab would be doing crawling around a beehive, but never mind. Above the two pairs is a star marking one of Cancer's main claws; the other is just to the right of Regulus. Except for one hind claw extending off toward Procyon, the rest of the crab is left to your imagination. Those other stars near the bottom of the picture belong to something else.

Now it gets hard. Below the Bear's feet you see a V of stars, The left branch of the V belongs to the Bear and the Little Lion, but starting at the vertex of the V and zig-zagging upward along the right branch of the $V$ past the Bear's nose is Lynx. It actually extends upward off this map. It's not supposed to look like a lynx; legend has it that you need the eyes of a lynx in order to see it.

If my descriptions were a little hard to follow, I apologise. Get out your planisphere or your phone app, and follow along. And the next time you get a clear sky, take a few minutes to lie back in your lounge chair and look around in between the bright stuff.

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## Even Planets Have Their (Size) Limits

by Natalie Hinkel

## Senior Research Scientist at the Southwest Research Institute

Scientists have discovered over 4,000 exoplanets outside of our Solar System, according to NASA's Exoplanet Archive. Some of these planets orbit multiple stars at the same time. Certain planets are so close to their star that it takes only a handful of days to make one revolution, compared to the Earth which takes 365.25 days. Others slingshot around their star with extremely oblong orbits, unlike the Earth's circular one. When it comes to how exoplanets behave and where they exist, there are many possibilities. And yet, when it comes to sizes of planets, specifically their mass and radius, there are some limitations. And for that, we have physics to blame.


This sketch illustrates a family tree of exoplanets starting from the protoplanetary disk, which is a swirling disk of gas and dust surrounding a planet (much like a stellar disk but smaller). Gas and dust is pulled onto the planet, depending on the planet's mass and gravity. NASA/Ames Research Center/JPL-Caltech/Tim Pyle

I am a planetary astrophysicist and I try to understand what makes a planet able to support life. I look at the chemical connection between stars and their exoplanets and how the interior structure and mineralogy of different sized planets compare to each other.

## Rocky versus gaseous planets

In our Solar System, we have two kinds of planets: small, rocky, dense planets that are similar to Earth and large, gaseous planets like Jupiter. From what we astrophysicists have detected so far, most planets fall into these two categories. In fact, when we look at the data from planet-hunting missions such as the Kepler mission or from the Transiting Exoplanet System Satellite, there is a gap in the planet sizes. Namely, there aren't many planets that fulfill the definition of a "super-Earth," with a radius of one and a half to twice Earth's radius and a mass that is five to 10 times greater.

So the question is, why aren't there any super-Earths? Why do astronomers only see small rocky planets and enormous gaseous planets? The differences between the two kinds of planets, and the reason for this super-Earth gap, has everything to do with a planet's atmosphere - especially when the planet is forming. When a star is born, a huge ball of gas comes together, starts to spin, collapses in on itself and ignites a fusion reaction within the star's core. This process isn't perfect; there is a lot of extra gas and dust left over after the star is formed. The extra material continues to rotate around the star until it eventually forms into a stellar disk: a flat, ring-shaped collection of gas, dust, and rocks. During all of this motion and commotion, the dust grains slam into each other, forming pebbles which then grow into larger and larger boulders until they form planets.

As the planet grows in size, its mass and therefore gravity increases, allowing it to capture not only the accumulated dust and rocksbut also the gas, which forms an atmosphere. There is lots of gas within the stellar disk - after all, hydrogen and helium are the most common elements in stars and in the universe. However, there is considerably less rocky material because only a limited amount was made during star formation.


Comparison of confirmed super-Earth planets compared to the size of the Earth. Left-toright: Kepler-22b, Kepler-69c, Kepler-452b, Kepler-62f, Kepler-186f, Earth. NASA/Ames/JPL-Caltech

## The trouble with super-Earths

If a planet remains relatively small, with a radius less than 1.5 times Earth's radius, then its gravity is not strong enough to hold onto a huge amount of atmosphere, like what's on Neptune or Jupiter. If, however, it continues to grow larger, then it captures more and more gas which forms an atmosphere that causes it to swell to the size of Neptune (four times Earth's radius) or Jupiter, 11 times Earth's radius. Therefore, a planet either stays small and rocky, or it becomes a large, gaseous planet.

The middle ground, where a super-Earth might be formed, is very difficult because, once it has enough mass and gravitational pull, it needs the exact right circumstances to stop the avalanche of gas from piling onto the planet and puffing it up. This is sometimes referred to as "unstable equilibrium" - such that when a body (or a planet) is slightly displaced (a little bit more gas is added) it departs further from the original position (and becomes a giant planet).

Another factor to consider is that once a planet is formed, it doesn't always stay in the same orbit. Sometimes planets move or migrate towards their host star. As the planet gets closer to the star, its atmosphere heats up causing the atoms and molecules to move very fast and escape the planet's gravitational pull. So some of the small rocky planets are actually the cores of bigger planets that have been stripped of their atmosphere.

So, while there are no super huge rocky planets or small fluffy planets, there is still a huge amount of diversity in planet sizes, geometries and compositions.
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# (More) Moon Stories from Around the World Storytelling is a human tradition 

[Continued from last issue.]

## Scandinavia: Jack and Jill

Hyuki (Jack) and Bil (Jill) were sent up the hill to fetch a pail of water from a magical well. Water from this well inspired poetry and prophecy. The children were spotted by the man who carries the Moon across the sky each night in his chariot. He scooped them up into his chariot and carried them away. The two children can still be seen there today, along with their bucket and pole. Can you find the splash from the spilled bucket?


## Australia: Bahloo the Moon

Back in the Dreamtime, Bahloo (Moon) visited theEarth and saw two young women who invited him to ride in their canoe. He was unsteady in the little craft and fell into the water. Embarrassed by his clumsiness, he hid. Although he now shines brightly every month, he remembers this little accident and shrinks away to gather his courage. Can you find the embarrassed Bahloo in the Full Moon?


## New Zealand: Moon Woman

The Maori call the woman in the Moon Rona. On a moonlit night she was returning from a stream with a calabash full of water. Moon slipped behind a cloud for a moment, and in the darkness Rona stumbled on the root of a tree. Angry, she cursed Moon. Moon, who would not stand for this abuse, swooped down on her and carried her off along with her water gourd and the tree that had tripped her. The Maori still see all three there today. Can you?


## After Words

In five billion years, the Sun enters its red giant phase and engulfs Mercury, Venus, and perhaps Earth; and Pluto is like "So now who's not a planet?"

How many astronomers does it take to change a light bulb? None, if it was already burned out.

Black holes are most commonly found in black socks.
The Hubble Telescope has just taken the best picture yet of a pair of colliding galaxies. In fact, the resolution is so good that you can actually see lawyers rushing to the scene.

Newbie: "I don't think my telescope is aligned properly; can you help me?" Expert: "Sure! I'll look into it!"

I was up all night wondering where the sun had gone ... then it dawned on me.

Telescopes: Refractor vs Reflector

| REFRACTOR |
| :--- | :--- |
| -MORE EXPENSIVE <br> -LESS COMPACT <br> -CHROMTIC ABERRATON <br> -REDUEED LGHT-GATHERING |

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