Issue 2017-11

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The Newsletter of the Eugene Astronomical Society

PO Box 7264
Springfield, OR 97475

Next Meeting: *Thursday, November 16*

Gravity Waves: Astounding New Insights on the Universe

Bernie Bopp, Professor of Astronomy Emeritus

On September 15, 2015, just before 11 AM Greenwich time, two Laser Interferometer Gravitational-Wave Observatories (LIGO) in Louisiana and Washington state experienced a distortion of spacetime equivalent to one ten- thousandth the diameter of a proton. Gravity waves from two merging Black Holes, over a billion light years away, had been detected for the first time. The successful detection of gravity waves was announced in 2016. In 2017 Rainer Weiss, Kip Thorne and Barry Barish were awarded the Nobel Prize in Physics for their roles in this research.

In the 20th century, astronomy was revolutionized by new instruments that could detect energies outside the visible light spectrum, such as radio waves, ultraviolet radiation, X-rays, and gamma-rays. The 21st century will see another observational revolution as LIGO and additional space-based gravity wave detectors allow us to probe the formation and evolution of neutron stars, close binary stars, and supermassive Black Holes. Astounding new insights and discoveries await us.

At our November 16th meeting, Bernie Bopp will discuss the detection of gravity waves and its impact on the future of astronomy. This will be a fascinating talk. Don't miss it! The meeting starts at 7:00 at the Science Factory planetarium. Come early to visit and get a seat.

Also, dues are due! If you haven't renewed yet, bring your $25 to Jerry or Kathy Oltion. We should also have the astronomy calendars by then, so if you ordered a calendar you can pick it up at the meeting.

EAS

President
Diane Martin (541-554-8570)

Secretary
Jerry Oltion (541-343-4758)

Additional Board members
Jim Murray
Oggie Golub
Andy Edelen

Annual Club Dues $25
Meetings at 7:00 at the
Science Factory, Eugene

EAS is a proud member of the
Astronomical League

October Meeting Report

At our October meeting—almost coincident with the 60th anniversary of the launch of Sputnik I in 1957—Kirk Taylor discussed his experience as a member of Operation Moonwatch.

1957 was the International Geophysical Year, but Moonwatch actually preceded it; the program was first proposed by the Smithsonian Astrophysical Observatory's (SAO) Fred Whipple in 1955, for the sake of tracking the satellites that the US and USSR were preparing as part of the Space Race. At the time, there were no computers available to calculate the orbital elements of satellites, and Moonwatch was created as a way of gathering this data (altitudes, azimuths, and transit times). By 1957, numerous Moonwatch groups had sprung up in the US and abroad. Kirk joined the Sacramento group (actually in Davis) in '57. This group ran until 1980, six years after the project was officially terminated.

Sputnik was launched on October 4th, 1957, and the first US satellite (Explorer 1) followed exactly 3 months later. A major problem with these satellites was that there was little knowledge of how to track them; their orbital elements were calculated pre-launch by the women NASA employed as "human computers," and these elements were given to the Moonwatch teams for further refinement once the satellites were in orbit. Each observation included the observer's latitude and longitude and the satellite's coordinates and transit time. These were sent to the SAO, where they were used to further refine the orbital elements for the sake of making future elements even more precise.

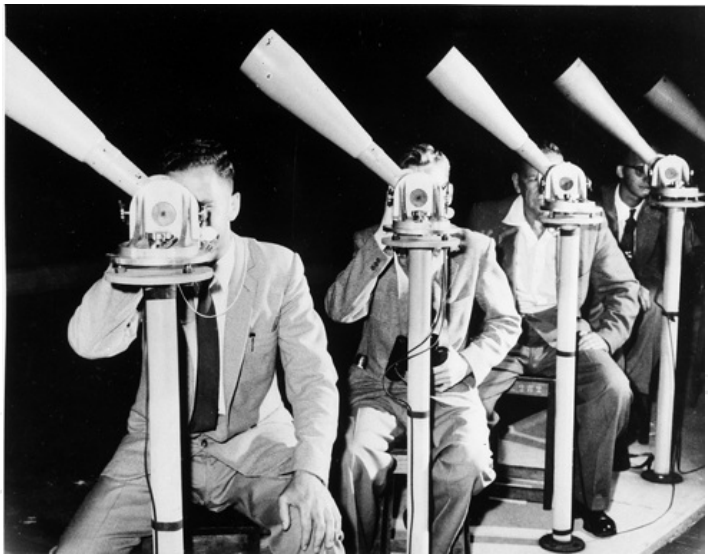
Each Moonwatch team consisted of 8 observers with telescopes arrayed in a north-south line; the telescopes were usually 6-8x and had fields that overlapped. (The observers in the middle of the line were all but expected to be the ones to recover the satellite.) Each observer had an assistant who took notes from the observer. All of the observers and assistants were amateur astronomers. The observers had stopwatches; when a satellite passed into the field of view, the observer started his stopwatch. After the session, he would give the stopwatch to the group leader, who would compute the time of the satellite's passing by subtracting the stopwatch time from the time given by the official national time standard on WWV.

The telescopes involved in Moonwatch were sometimes homemade, sometimes commercially made (by Edmund Scientific or Unitron), and sometimes professional scopes (often war surplus M-17 elbow scopes). All of these scopes had difficulty tracking satellites if they were dim and/or at apogee, so the leader of the Sacramento group, Arthur Leonard, developed a more-effective scope by adding a 5" objective to the M-17 scope, dubbed the Apogee scope. The SAO made this the primary telescope of Operation Moonwatch.

Operation Moonwatch was never intended to be the main method of tracking satellites—this should have been the photographic Spacetrack project, which used 20" Schmidt cameras to take plates of wide swaths of the sky. Spacetrack didn't become operational until 1961, however, and even when it was working it never entirely replaced Moonwatch as a means of tracking satellites.

Kirk recalled waking up at 3 AM to get to Davis by 4:30, when satellites would often be visible. He was the first observer to catch American satellite Epsilon in 1959, and his group was also the first group to recover the Omicron satellite two years later.

Thanks, Kirk, for a great presentation!



Above left: Pretoria, South Africa's Operation Moonwatch chapter with 5" Agogee scopes. *Photo courtesy Smithsonian Archives*. *Above right:* the pin given to members of Operation Moonwatch, in honor of the 1957 International Geophysical Year. *Photo courtesy Sky & Telescope.*

Meeting business: Officers were elected for the 2017-2018 EAS board of directors, President, and Secretary. Diane Martin and Jerry Oltion were re-elected as President and Secretary; Oggie Golub and Andy Edelen were elected to the board of directors, joining Jim Murray on the board.

First Quarter Friday Report

Our First Quarter Friday for October was quite a success: the weather cooperated and about thirty people joined a dozen members of EAS at the College Hill Reservoir. Observed objects included the Moon, Saturn, Uranus, Neptune, M57, and M13.

Our final First Quarter Fridays for 2017 are November 24 (34% lit) and December 29 (87% lit).

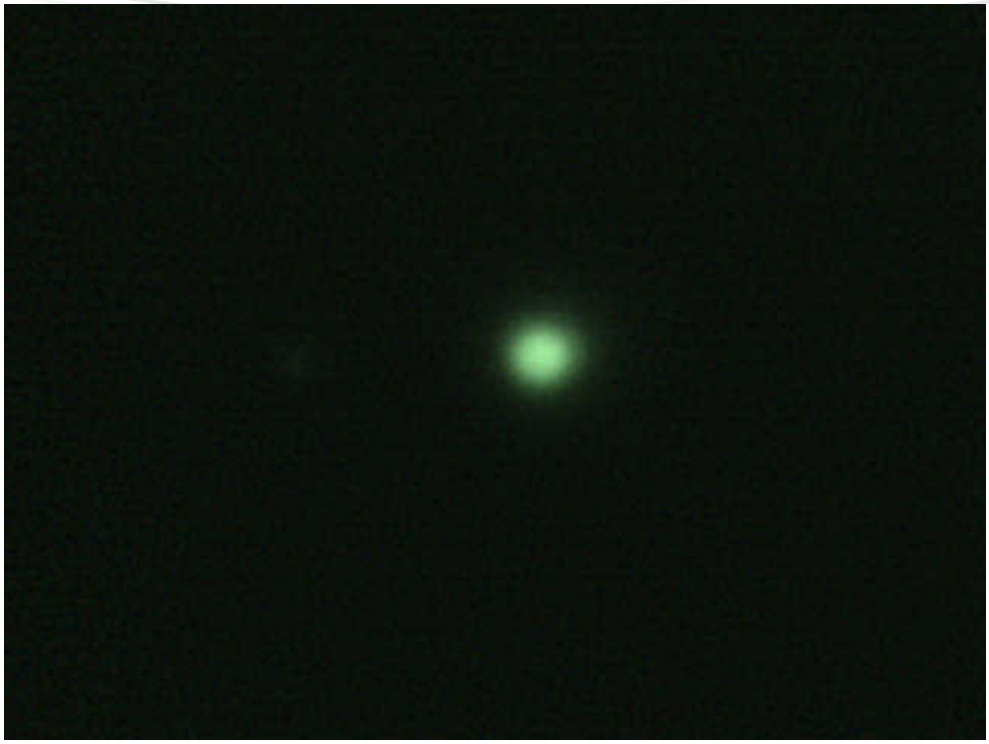
EAS Dues

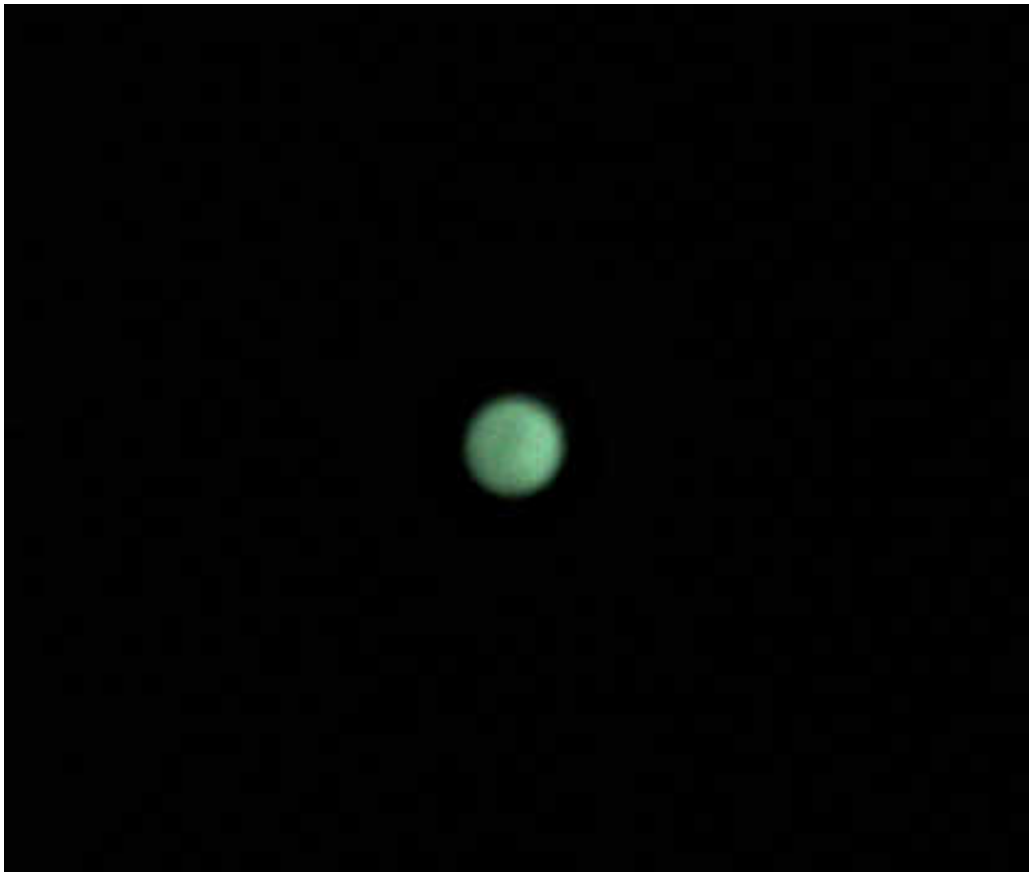
Dues are due! If you haven't renewed yet, bring your $25 to Jerry or Kathy Oltion at the November meeting. We should also have the astronomy calendars by then, so if you ordered a calendar you can pick it up at the meeting.

EAS Members' Gallery

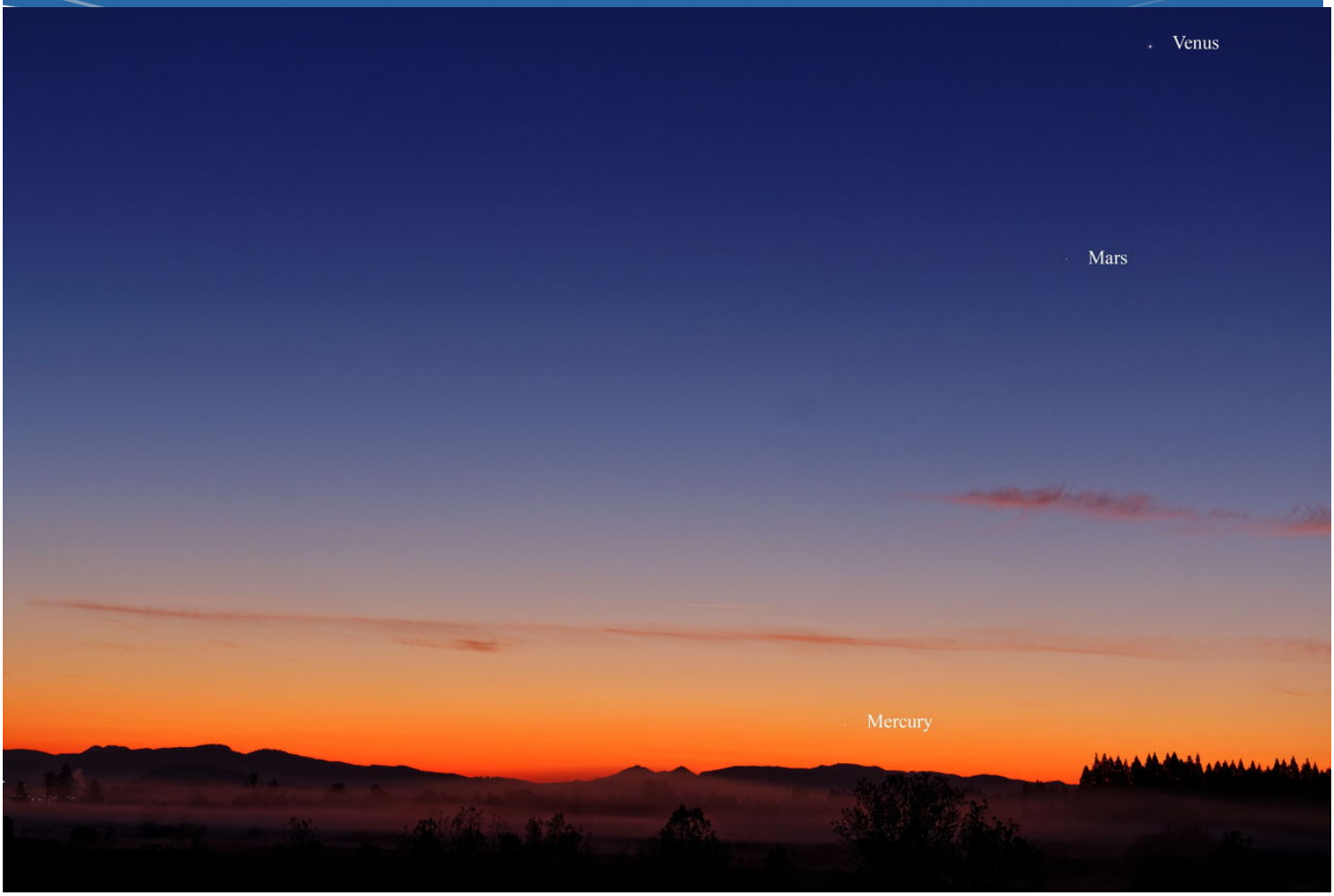
Above: Integrated Flux Nebula in Serpens Caput. *Sketch by Mel Bartels.*

Below: The Moon, October 17th. *Photo by Alan Gillespie*.





Top: Neptune and its moon Triton (to left). *Below:* Uranus.
Photos by Jeff Phillips.



Above: Three Sisters, three planets. *Photo by Alan Gillespie*.

Below: Double rainbow at the College Hill Reservoir. *Photo by Emily Votaw.*

Orion's Belt and Sword. *Photo by Alan Gillespie.*

A farewell to Sagittarius. *Photo by Alan Gillespie.*

Sun & Moon rise and set for November

Date	Moonrise	Moon Set	Twilight Begin	Sunrise	Sun Set	Twilight End
11/1/2017	17:08	04:36	06:12	07:50	18:02	19:40
11/2/2017	17:40	05:46	06:13	07:51	18:01	19:39
11/3/2017	18:15	06:58	06:14	07:52	17:59	19:37
11/4/2017	18:54	08:12	06:15	07:53	17:58	19:36
11/5/2017	18:38	08:27	05:16	06:55	16:57	18:35
11/6/2017	19:29	09:39	05:17	06:56	16:55	18:34
11/7/2017	20:28	10:45	05:19	06:57	16:54	18:33
11/8/2017	21:31	11:44	05:20	06:59	16:53	18:32
11/9/2017	22:38	12:34	05:21	07:00	16:52	18:31
11/10/2017	23:46	13:17	05:22	07:01	16:51	18:30
11/11/2017		13:53	05:23	07:03	16:50	18:29
11/12/2017	00:53	14:25	05:24	07:04	16:49	18:28
11/13/2017	01:59	14:55	05:25	07:05	16:48	18:28
11/14/2017	03:03	15:23	05:27	07:07	16:47	18:27
11/15/2017	04:06	15:51	05:28	07:08	16:46	18:26
11/16/2017	05:08	16:19	05:29	07:09	16:45	18:25
11/17/2017	06:09	16:50	05:30	07:11	16:44	18:25
11/18/2017	07:09	17:23	05:31	07:12	16:43	18:24
11/19/2017	08:07	18:00	05:32	07:13	16:42	18:23
11/20/2017	09:02	18:41	05:33	07:14	16:41	18:23
11/21/2017	09:54	19:27	05:34	07:16	16:41	18:22
11/22/2017	10:41	20:17	05:35	07:17	16:40	18:22
11/23/2017	11:23	21:11	05:36	07:18	16:39	18:21
11/24/2017	12:01	22:08	05:37	07:19	16:39	18:21
11/25/2017	12:35	23:08	05:38	07:21	16:38	18:20
11/26/2017	13:07		05:39	07:22	16:38	18:20
11/27/2017	13:37	00:10	05:40	07:23	16:37	18:20
11/28/2017	14:06	01:15	05:41	07:24	16:37	18:19
11/29/2017	14:36	02:22	05:42	07:25	16:36	18:19
11/30/2017	15:08	03:32	05:43	07:27	16:36	18:19

All times are for Eugene, Oregon (Latitude 44° 3' Longitude 123° 06')

Observing In November

Full | Last Q | New | 1st Q

Nov 3, 10:23 PM	Nov 10, 12:36 PM	Nov 18, 3:42 AM	Nov 26, 9:03 AM
Mercury Set: 6:33 PM	Mercury Set: 5:35 PM	Mercury Set: 5:41 PM	Mercury Set: 5:46 PM
Venus Rise: 6:25 AM	Venus Rise: 5:43 AM	Venus Rise: 6:05 AM	Venus Rise: 6:26 AM
Mars Rise: 4:54 AM	Mars Rise: 3:49 AM	Mars Rise: 3:44 AM	Mars Rise: 3:39 AM
Jupiter Rise: 7:19 AM	Jupiter Rise: 5:59 AM	Jupiter Rise: 5:37 AM	Jupiter Rise: 5:14 AM
Saturn Set: 8:26 PM	Saturn Set: 7:01 PM	Saturn Set: 6:33 PM	Saturn Set: 6:05 PM
Uranus Set: 6:38 AM	Uranus Set: 5:09 AM	Uranus Set: 4:36 AM	Uranus Set: 4:03 AM
Neptune Set: 2:46 AM	Neptune Set: 1:18 AM	Neptune Set: 00:47 AM	Neptune Set: 00:15 AM
Pluto Set: 10:05 PM	Pluto Set: 8:38 PM	Pluto Set: 8:07 PM	Pluto Set: 7:37 PM

Items of Interest This Month

NOVEMBER

11/11 Moon occults Regulus in daytime (8:36 AM. Reappearance 9:31 AM)

11/13 Venus within 1/2° of Jupiter in early morning

11/17 Leonid meteor shower peaks in AM

11/23 Mercury at greatest eastern elongation (visible low in west after sunset).

11/24 First Quarter Friday star party

Last week: Mercury near Saturn, visible low in west just after Sunset.