Friends Of Galileo ASTRONOMY CLUB

Program: Measuring cosmic distance.

Volume 27, No.06
October 2021

Greg Smith – editor.

Meeting: October 15, 2021

Saying Goodbye

Chuck Ring, founding club leader and many times club past president, and his wife, Sue, have been very active members in most FOG club activities since 1995. Sadly, they are moving to West Seattle to live closer to family after 46 years in their Kelso home.

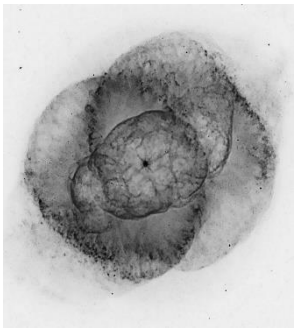
Chuck, a career salesman, has always been FOG's enthusiastic promoter, very personable recruiter, and community connecter. He and Sue Piper shared their common interest in astronomy at Toastmasters and started our club in spring 1995. They started with a public viewing in Feb. '95, even before owning any telescopes. Chuck greeted all visitors at those impromptu star parties and recruited to join the club. Chuck and Sue endured icy roads and a car wreck to meet Cal Zambuto, regional Telescope maker. They enticed Carl (now nationally known mirror manufacturer) to teach a mirror grinding and telescope making class to their fledgling group of a dozen astronomy enthusiasts. World famous astrophysicist, James Dobson, Ph.D. lectured our group at Jepson's workshop at the commissioning of 9 completed 6''-8' Dobs. I joined the first official club meeting in May '95. Since then, we have met monthly for a scientific program and enjoyed sharing our friendship and interests as astronomy hobbyists.

Chuck would frequently setup his new telescope at the Allen St. gas station on clear evenings to invite any passerby to look at the moon. Chuck and Sue always helped with the July solar Picnic, the December potluck Christmas Party and white elephant astro-gift

exchange, the Earth Day FOG booth, special public viewings for lunar eclipses, transits, comets, and school events. They helped with newly started Winter Solstice Lantern Walk at Lake Sacajawea, the biennial painting of the Human Sundial at LCC with Steve Powell, Peg, Mark, Greg, or Bill, and the annual Mt. Saint Helens Star Party. Chuck enjoyed cultivating relationships with our monthly guest astronomy speakers at the pre-meeting dinners. He maintained contact with our NASA Solar System Ambassadors, Les Hastings and Greg Cermac. Chuck was passionate about outreach with Sidewalk Astronomy viewing. He was our faithful liaison with Andre Stepankowsky, The Daily News Editor, who published articles that promoted our educational public astronomy events including the 2017 Solar Eclipse. Chuck's friendly demeanor encouraged many local astronomy aficionados to keep looking up at the starry nights. Chuck is bringing his 8" Dob to their new home. We are excited to stay connected with him through our zoom hybrid meetings. Chuck and Sue feel blessed with their 4 children and 8 grandchildren, who he says, "turned out pretty good!" They are enjoying the loving attention from their family. But they cherish the fun that we shared in our friendship through Friends of Galileo during 26 years. Please consider corresponding with Chuck and Sue Ring at: Brookdale West Seattle, 4611 35th Ave. SW, Seattle, WA 98126.

by Mark Thorson

Every Day is a Star Filled Day,
Every Night is a Starry Night



Gold in them thar Stars

How neutron star collisions flooded Earth with gold and other precious metals.

By Paul Sutter

It killed some alternate ideas about gravity, too!

The universe is pretty good at smashing things together. All kinds of stuff collides — stars, black holes and ultra-dense objects called neutron stars.

And when neutron stars do it, the collisions release a flood of elements necessary for life.

Just about everything has collided at one point or another in the history of the universe, so astronomers had long figured that neutron stars — superdense objects born in the explosive deaths of large stars — smashed together, too. But starting about a decade ago, astronomers realized that the collision of neutron stars would be particularly interesting.

For one, a neutron star collision would go out with a flash. It wouldn't be as bright as a typical supernova, which happens when large stars explode. But astronomers predicted that an explosion generated from a neutron star collision would be roughly a thousand times brighter than a typical nova, so they dubbed it a kilonova — and the name stuck.

As the name suggests, neutron stars are made of a lot of neutrons. And when you put a bunch of neutrons in a high-energy environment, they start to combine, transform, splinter off and do all sorts of other wild nuclear reaction things.

The birth of elements

With all the neutrons flying around and combining with each other, and all the energy needed to power the nuclear reactions, kilonovas are responsible for producing enormous amounts of heavy elements, including gold, silver, and xenon. Together with their cousins, supernovas, kilonovas fill out the periodic table and generate all the elements necessary to make rocky planets ready to host living organisms.

In 2017, astronomers witnessed their first kilonova. The event occurred about 140 million light-years from Earth and was first heralded by the appearance of a certain pattern of gravitational waves, or ripples in space-time, washing over Earth.

These gravitational waves were detected by the Laser Interferometer Gravitational-Wave Observatory (LIGO) and the Virgo observatory, which immediately notified the astronomical community that they had seen the distinct ripple in space-time that could only mean that two neutron stars had collided. Less than 2 seconds later, the Fermi Gamma-ray Space Telescope detected a gamma-ray burst — a brief, bright flash of gamma-rays.

A flurry of scientific interest followed, as astronomers around the world trained their telescopes, antennas, and orbiting observatories at the kilonova event, scanning it in every wavelength of the electromagnetic spectrum. All told, about one-third of the entire astronomical community around the globe participated in the effort. It was perhaps the most widely described astronomical event in human history, with over 100 papers on the subject appearing within the first two months.

Kilonovas had long been predicted, but with an occurrence rate of 1 every 100,000 years per galaxy, astronomers weren't really expecting to see one so soon. (In comparison, supernovas occur once every few decades in each galaxy.)

And the addition of gravitational wave signals provided an unprecedented glimpse inside the event itself. Between gravitational waves and traditional electromagnetic observations, astronomers got a complete picture from the moment the merger began.

That kilonova alone produced more than 100 Earths' worth of pure, solid precious metals, confirming that these explosions are fantastic at creating heavy elements.

In short, the gold in your jewelry was forged from two neutron stars that collided long before the birth of the solar system.

The death of modified gravity

But that wasn't the only reason the kilonova observations were so fascinating. Albert Einstein's theory of general relativity predicted that gravitational waves travel at the speed of light. But astronomers have long been trying to develop extensions and modifications to general relativity, and the vast majority of those extensions and modifications predicted different speeds for gravitational waves.

With that single kilonova event, the universe gave us the perfect place to test this. The gravitational wave signal and the gamma-ray burst signal from the kilonova arrived within 1.7 seconds of each other. But that was after traveling over 140 million miles (225 million kilometers). To arrive at Earth that close to each other over such a long journey, the gravitational waves and electromagnetic waves would have had to travel at the same speed to one part in a million billion.

That single measurement was a billion times more precise than any previous observation, and thus wiped out the vast majority of modified theories of gravity.

No wonder a third of astronomers worldwide found it interesting.

Minutes of the September Meeting

9/15/2021 Hybrid-Zoom Meeting Minutes

Attendees online: Pres. Ted G. at Lookout Rd. club Star Party, zoom-host Mark T., Treasurer Steve P., Erik K., Becky K., Bruce P., Chuck R., Chuck W., RCA-Liaison Howard K.;

Attendees in person: Lookout Rd. club Star Party: Host Mike F., Steve & Steph F. with guest Pavel.

Pres. Ted welcomed attendees at 19:05 from Lookout Rd. club star party site at Mike's place for our second hybrid-zoom meeting. Announcements included: 1. future meeting site at RA Long HS; 2. quick notice of future ad hoc club Star Parties at Mike's place.

Mark screen shared the scientific program YouTube video by ESA "Soyuz-ISS Rendezvous". Before intermission we announced that Chuck and Sue Ring were moving to West Seattle in October. They were honored for their 26 years of active club involvement. Chuck started FoG with Sue Piper in spring 1995. Chuck's faithful service included: president, publicity, 1995 telescope-making class by Zambuto and inviting James Dobson, special events for public viewing, Earth Day exhibits, Solstice Walk, etc. Sue helped him with Picnics, Christmas Parties, painting the Human Sundial and welcoming members.

Ted presented the Sky Report, now available on the club website. The Business meeting included Roy's update for planning for Saturday 12/18/2021 "Solstice Lantern Walk at Lake Sacajawea" requiring city permit fees, volunteer for our FoG booth at the Sun, portable toilet rentals, printed passports and stamps, event advertising, management for Sponsors' $50 fees, "Space Shuttle" vans, and volunteers to help coordinate this event.

Howard Knytych, RCA Liaison, announced that he will be discussing Cepheid variables and other techniques for measuring cosmic distances at our next meeting Wednesday, October 20th with location vs. (zoom?) pending. Thank you, Greg Smith, club editor, for your excellent Sept. FoG Newsletter and CRR article. Submitted by Mark Thorson, VP

☞ October 2021 Meeting ☜

DATE: **Wed October 20, 2021**
TIME **7:00pm** This is a hybrid Zoom/live meeting
PLACE: **R A Long High School Rm 130 in Science Wing**
When facing the school, the science wing is to the left. Walk down the pathway leading to the science wing and **Room 130** is clearly labeled in the window and on the door.
Masks are required as per state mandate, and FoG further asks that you be fully vaccinated to attend.

PROGRAM**: Cepheid variables and other techniques for measuring cosmic distance**.
Presented by: Howard Knytych, RCA Liaison

The Star Report is posted on the clubs website: www.friendsofgalileo.com. It is listed in the blog portion of the website.

End of twilight - when the brightest stars start to come out.

Wed Oct 20 **6:46 pm** Sun, Oct 31 **6:29 pm** Tues, Nov 16 **5:11 pm**

Friends of Galileo Club Officers

PRESIDENT	Ted Gruber
VICE-PRESIDENT/ PROGRAM CHAIR	Mark Thorson
SECRETARY	Greg Smith
TREASURER	Steve Powell
WEBSITE	Ted Gruber
NEWSLETTER ED.	Greg Smith
ALCOR	Tom Meek

Next Month's Newsletter Deadline

The deadline for items in next month's newsletter is:

Wednesday: seven days before next meeting.

Please feel free to send in your thoughts and experiences about your astronomical adventures.

Submit your material by E-mail to: grlyth@msn.com

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