Volume 34 Issue 9

September 2020

The Observer

Star Factory M17 - APOD 10/22/2015
Image Credit & Copyright: ESO / MPIA / OAC, R.Colombari

Upcoming Events:

Some meetings will be held online.

EVAC Meeting via Zoom - September 18

Featured Speaker is Rogier Windhorst - Jsmes Webb Space Telescope.

Inside this Issue:

From the Desk of the President

by Gordon Rosner

Greetings from your President.

I sure hope everyone is still doing well and keeping healthy. And as we all know, we are still deep in public health concerns. Sadly, it still looks like that is going to continue for some time. Our Leadership Team held an online meeting on 19 August and our Board of Directors voted to continue all EVAC in-person group activities to remain cancelled, and we are still uncertain when events will return. Claude Haynes, our GRCO Observatory Manager, sent a survey out to all GRCO operators to get their thoughts from our dedicated volunteers. The operators are certainly still a team and eager to get back in the dome when safety allows. But, GRCO still remains closed. As mentioned last month, our Leadership Team continues to monitor other Arizona astronomy clubs for any positive thoughts and actions. As always, check our website for the latest information.

As mentioned during our August online General Membership Meeting, the Hovatter Airfield is no longer available to us as our dark sky location that was used for the Messier Marathon and All Arizona Star Party. Both EVAC and the Saguaro Astronomy Club historically had an annual use agreement with the Bureau of Land Management to use that site for club activities. The BLM transferred that land to La Paz County for the construction of a large solar energy facility resulting in the cancellation of our BLM agreement. The area now can not be used by our clubs for

From the Desk of the President

by Gordon Rosner

Continued from page 1

any reason as no use agreement exists with La Paz County. We do not know when actual construction will start. Both EVAC and SAC are working to find a replacement dark sky site. However, because of the current health environment, and the time it would take to find a new site and negotiate a new use agreement with the new site owners, this year's All Arizona Star Party scheduled in October has been cancelled. Again, check our website for the latest information.

I must again remind everyone that any in-person gatherings are up to individuals and none are EVAC sponsored events at this time. This also applies to any gatherings at the Picket Post Trailhead. Those gatherings are personal decisions and proper safety precautions must be observed by each individual. Any group gatherings are entirely personal decisions with no EVAC endorsement, guidance, or oversight at this time.

This year certainly continues to be tough on our club as it seems new challenges hit us one after the other. I'm sure everyone personally can say the same thing. However, I must proudly remind everyone that our club remains operationally strong, and we have turned some new negatives into new positives. Our online meetings are very successful and gives us a new opportunity to grow with. We have also helped SAC with their first online monthly meeting, and, as our clubs support each other, we have grown closer as we share future hopes and ideas on how to get there. Our EVAC Facebook page remains active and is a showcase of some great photos from fledgling astrophotographers to some of the best technical artists you will ever find, and all those in between. I especially enjoy seeing the photographs and comments of those new to the productive struggles of astrophotography and sharing the thrill of their first photos that finally were actually in focus! Keep at it. You're an encouragement to others. Wonderful stuff!

Our Board of Directors has also agreed that our online monthly meetings can be recorded, and a link placed on the monthly meeting page of our club website, when we have the presenter's permission. Again, we pulled another positive from the negative of people missing our meetings. Now all those who could not watch the meeting live can view it at their convenience. We certainly have some great presentations from our members and industry professionals, and we want to make sure everyone has the opportunity to view them.

Speaking of our online monthly meetings, member presentations are a valuable part of these. You are the club. And anything you personally do in your passion of astronomy can also be a valuable part of the club via a member presentation. These are about ten minutes long and I encourage you to do one of these. Plus, it just could be fun for you to be able to say "Yeah. I gave a Zoom meeting presentation. It's easy.". Just let me know you would like to do this by using the 'Contact President' link near the bottom of the main page of our EVAC website. I'll then get back with you and we can discuss. If needed, we can also do a dry run sometime before the actual meeting. Our September meeting will be held on Friday, 18 September starting at 7:30PM. The main speaker will be Dr. Rogier Windhorst presenting the latest on the James Webb Space Telescope. I'll 'see' you then.

"Keep your feet on the ground and keep reaching for the stars."

Your President, Gordon Rosner

EVAC Zoom Meeting Notes for 2020 August 21, at 07:30 P.M. AZ Time

by Wayne Thomas

Meeting minutes.

President Gordon Rosner welcomed those in the "audience" to the Zoom meeting at 7:30 p.m. with 130 registered to attend. He received permission from the evening's presenter, Babak Tafreshi, to record the meeting. Gordon introduced the team in charge of keeping EVAC running.

Under club news, he noted that Picket Post is available for observing but that it was a personal decision and not a club sponsored activity. He reported that the Hovatter observing site is no longer available for observing since it has been transferred from BLM control to LaPaz County to be used for a solar generating facility. A new observing location is being sought. He encouraged any who would like to make a member presentation to contact him at president@evaconline.org.

EVAC Zoom Meeting Notes for 2020 August 21, at 07:30 P.M. AZ Time

by Wayne Thomas

Continued from page 2

The first member presentation was given by Bill Peters, a tongue in cheek story of how a meteorite could be used to BBQ ribs. In his presentation he paid tribute to the late Gerry Rattley. However, one question remains – what is the best BBQ Sauce for meteorite BBQ?

The second member presentation was given by Tom Polakis who shared images of comet C/2020 F3, a.k.a. comet NEOWISE, taken from various locations around Arizona during July. These were taken both in the morning sky and later in the evening sky when the comet was brightest.

Tom Mozdzen then introduced the main speaker, Babak Tafreshi, who shared many beautiful pictures taken from around the world. Babak is the founder of TWAN, The World at Night program. He is one of 40 photographers from 20 countries who want to show what the night sky looks like from many historic and scenic places. Their focus is not on astrophotography, but on the realistic appearance of the heavens with relatable foreground scenes. His photography is often done when it is not totally dark but during twilight with but a few stars visible. The resulting images are useful to communicators and to educators to share what the sky looks like universally around the world.

In his presentation he shared images showing many phenomena observable around twilight, such as the Earth's shadow alongside the glow of sunset, rays of shadow opposite the sun (anti-crepuscular rays), wild animals at night, mountains illuminated by moonlight, aurora, airglow, zodiacal light, artificial light, and its impact on birds. "Nightscape photography is the art of handling the ambient light," for example car lights on a highway in the mountains. His goal is to show a realistic representation of nature, which usually does not include multiple exposures (such as in Astrophotography). This he stated is to respect the rules of nature, for example to represent the colors of stars and galaxies as true to nature as possible.

The Nightscape Photographer must travel light to be able to be at the best location quickly for the opportunity to capture a memorable moment. This is in contrast to the AP (Astro Photographer) who sets up the telescope in a location planning to spend the night imaging. The Nightscape Photographer uses the four main elements of photography – Art, Technique, Moment, and Story to produce images that will endure.

Babak sees part of his mission as promoting peace around the world. The sky at night as seen above one country is the same as that seen above many other countries. All can share is the feeling of awe while observing the night sky from a dark site. However, on the dark sky topic, Babak states that 90% of the world's population has no concept of light pollution. He recommends approaching the subject from a positive perspective – for the good of the environment and wildlife, for our health, for energy efficiency, and for the future of planet Earth.

Babak was the photographer for a National Geographic article on light pollution, and he has published a book, "The World at Night," which is available in the usual places. A signed copy can be purchased from babaktafreshi.com. After Babak's presentation, president Gordon Rosner gave a short presentation on some of the equipment required to get started with Astrophotography with a DSLR camera. He showed the equipment needed to attach the camera to the back of an SCT.

Our next meeting will be on September 18 and our featured speaker will be Dr. Rogier Windhorst sharing the latest on the James Webb Space Telescope.

The total attendance at this meeting was 88 (out of about 200 who were invited). To be added to the invite list, contact Tom Mozdzen at vp@evaconline.org, or visit the EVAC FB page where the invitation link is posted as an announcement. The meeting was adjourned by Gordon/Tom around 9:05 p.m.

Wayne Thomas, Secretary

EVAC

The Backard Astronomer

by Bill Dellinges (September 2020)

Have You Ever Noticed…(?)

In the course of pursuing the hobby of astronomical observation, one eventually stumbles across what might be termed oddities, curiosities or coincidences. This month I would like to share a few of them with you.

1) Sometimes star names in a constellation refer to their being south or north, like the rear feet of Ursa Major – Alula Borealis, Alula Australis (Nu and Xi U. Maj.) and Tania Borealis, Tania Australis (Lambda and Mu U. Maj.). There's more! Asellus Borealis and Asellus Australis (Gamma and Delta Cancri, the northern and southern asses). Sauntering over to our old friend Sagittarius the Archer, we find his bow is composed of Kaus Borealis, Kaus Media, and Kaus Australis (Lambda, Delta and Epsilon Sagittarii, the top, middle and bottom stars of the bow).

2) If the Satyr doesn't freeze you with fear, you may have noticed within his domain some intriguing numerical sequences of Messier objects. Working top to bottom, we see M16 (technically in Serpens Cauda), M17, and M18. Just below M18 and running west to east, one finds M23, M24 and M25. Below them, running again west to east is M20, M21, and M22. In the southern part of the Teapot we spy, west to east, M69 and M70. A little farther east, practicing social distancing is M54 and M55.

3) Any double star fan, who has observed the lovely doubles Zeta and Beta Lyrae that form the west side of Lyra's parallelogram, was no doubt surprised to note that the stars' companions show almost identical magnitudes, separations and position angles: AD 4.4, 5.7, 43.7", 150^0, AB 3.4, 7.1, 45.7", 149^0 respectively and easily split in 16x70 binoculars.

4) Speaking of double stars, isn't it a joy to find another double star in the same field as the one you're observing? Three examples of these "twofers" are: Gamma Delphini (with nearby Struve 2725), Xi Scorpii (with Struve 1999), and Sigma Orionis (with Struve 761).

5) Due to precession, a wobble of Earth's axis, the star Thuban in Draco was our North Star during construction of the Great Pyramid of Giza around 2500 B.C. This magnitude 3.7 star is easily found. Simply draw a line perpendicular from the two bright Little Dipper Bowl stars to Mizar, the notable double star in the Big Dipper's Handle. Thuban will be the brightest star you see on that journey.

6) The spelling of the genitive or possessive form of the 88 constellations usually changes, such as Orion/Orionis, Scorpius/Scorpii, Lyra/Lyrae, etc. But have you ever noticed two don't: Puppis and Camelopardalis.

7) Have you ever noticed Antares and Altair have a similar arrangement of "buddy" stars on either side of them? And those attendants are about the same magnitude and distance from their primaries!

8) Just about every naked eye star you see at night is intrinsically larger and more luminous than our Sun. But most stars in the universe are the size of the Sun or smaller. Contradiction? No. It's just that stars are immensely distant, light years away, and only the light from the brightest stars reach us to register on our eyes. If the Sun was 32.6 light years away (rather than only 93 million miles distant), its brightness would decrease from -26.7 to +4.8, barely visible to the naked eye. Nature seems to have a proclivity for making more smaller things than larger things. To quote Fred Schaaf in The Brightest Stars, "For every spectral class O star, there are thousands of Sun-like G stars and hundreds of thousands of red dwarf M stars." You could say nature does the same thing here on Earth where you find more ants than elephants roaming about.

9) Am I the only stargazer who gets all twisted around trying to figure out where celestial east and west are when facing north? South is easy, any direction away from Polaris will be south. But east and west can be a little confusing. Solution: since the constellations revolve around Polaris counterclockwise, the direction in which they're moving must be west. Thus, for the stars above Polaris, celestial west is to your left. But wait. Once they dip below a horizontal line drawn through Polaris, the stars going west are now going down and slowly skimming the horizon under Polaris and heading to your right. So celestial west, insofar as star charts are concerned, is now to your right! Sigh.

The Core and Structure of Neutron Stars Part 1

by Henry De Jonge IV (September 2020)

Introduction

In this article I will discuss some recent updates regarding neutron stars (NS) paying particular attention to their core and interior structure. There are many more aspects of NS that we could discuss and this is only a small portion of the new and fascinating ideas and knowledge of NS that we are acquiring. We will bring together many areas of mathematics and theoretical physics that can be related to the fantastic experimental discoveries recently made via gravitational waves (GW) particle colliders, and supercomputers. The Universe tends to reveal much about itself in fundamental ways under extreme conditions and it is a truly exciting time to study NS.

NS contain the densest matter we currently know of in the universe since if it were any denser it would be a black hole. They were first theorized in the 1930's and discovered in the 1960's. Some of them also have the most powerful magnetic fields in our universe as well. In other words, they are an object of extremes as well as wonder.

We have progressed in our understanding of their interiors recently with the help of the recent data from LIGO and the detection of GW from a binary neutron star merger in 2017. To add to this there has recently been a second NS-NS merger detected via GW in 2020 but without the kilonova. We have also made significant progress in understanding their interiors due to the work in colliders, especially with the Relativistic Heavy Ion Collider (RHIC) and the Large Hadron Collider (LHC). These two main venues of experimental advancements have given us much information to advance the theoretical models considerably. The increased use of supercomputers with advanced modeling mathematics has also played a major role in furthering our knowledge. We will focus on the developments regarding the interior of NS with respect to these three major advances. Bear in mind that there are other ways to learn about NS and their interior structure including accretion events, x-ray analysis, Shapiro delay measurements, and neutrino analysis.

This article has been more challenging to write than most due to the much more speculative, technical, and theoretical aspects of the topic and the many (at least a dozen!) theoretical physics seminars on this and related topics recently. However, it has been a very fun and informative learning experience for me. For prior information on NS please see my previous articles on magnetars in November and December 2014, and neutron star mergers and kilonova in November 2017.

Neutron Star Overview

A neutron star is the collapsed core of a giant star which prior to collapse had a total mass of roughly between 8 and 30 solar masses, though these estimates vary. Neutron stars are the smallest and densest material compact objects in our universe, excluding black holes. They generally have a radius on the order of 10-12 km (6-7 mi) and a mass of about 1 solar mass. Basically they are the size of a city with the mass of the sun. They result from the core collapse supernova explosion of a massive star, combined with gravitational collapse, that compresses the core past the white dwarf star density (sustained by electron degeneracy pressure) to roughly that of atomic nuclei. Recall that when a NS is formed the compressed electrons and protons combine to produce neutrons. They are prevented from further collapse by neutron degeneracy pressure, which is basically the pressure of the strong interactions. In general, the larger the mass of the NS the smaller the radius. The most massive NS is thought to be about 2 solar masses and only three "stable" NS at or slightly above this 2 solar mass limit are currently known.

The cores of NS are thought to be quite hot in a relative sense, being in the 10,000,000 Kelvin degree range and hotter while the surfaces are thought to be in the 600,000 K range. The relationship between the core and surface temperatures of NS are very much tied to their internal structure, accretion, and intrinsic magnetic fields.

The Core and Structure of Neutron Stars Part 1

by Henry De Jonge IV (September 2020)

Continued from page 5

The core density of a NS is thought to be near or greater than that of a nucleus which is about 10^{14} g/cm^3 The outer crust density is about 10^6 g/cm^3. As we go deeper this density increases dramatically and essentially in only about one meter into a NS the material is denser than that of a white dwarf and is relativistic. The core density of a NS is thought to be about 2-3x greater that the nuclear density, possibly even up to even 10x greater or about 10^{15} g/cm^3. We know that the speed of sound in matter cannot exceed the speed of light so there is a limit to their density before they collapse into a black hole (BH). However, once we go beyond the density of nuclear matter and into the core there is still much speculation.

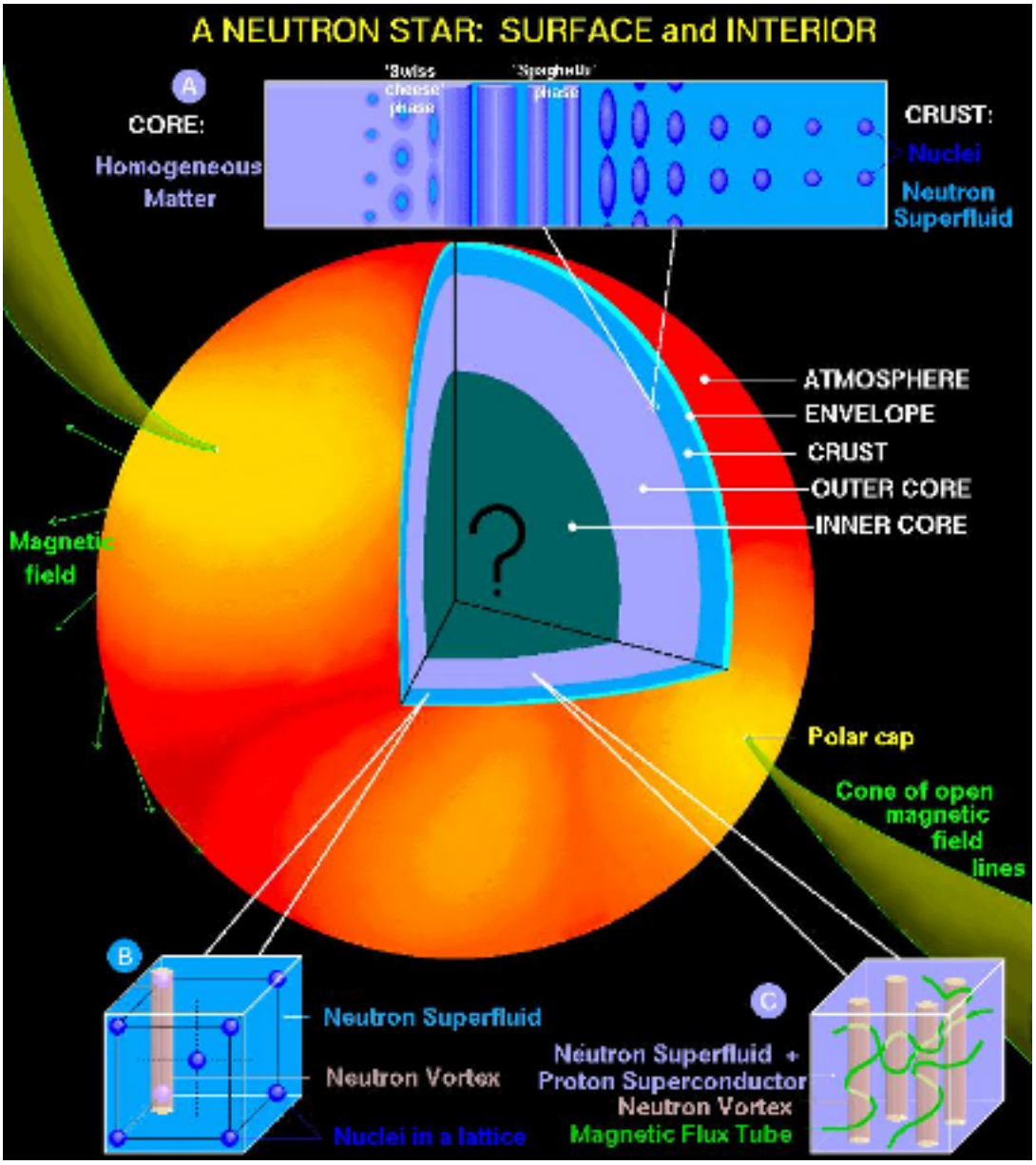

Figure 1. Rough overview of NS, (see below for more explanations)

LIGO Data

The detection in 2017 of GW from two merging NS, the resulting kilonova, and the GW detection in 2019 of a NS-BH merger gave us much information on the morphology, masses, and sizes of NS. The GW signal detected began about the last 100 or so orbits, which is about 10 milliseconds before the merger of these compact objects. Basically, they detected part of the inspiral, the merger, the ringdown, and some of the post-merger aspects of these events.

The Core and Structure of Neutron Stars Part 1

by Henry De Jonge IV (September 2020)

Continued from page 6

This analyzed GW signal was used to help us determine the approximate masses of the compact objects, their deformation during merger, as well as their approximate size. For example, the smaller the NS (more mass and higher density) the less deformation, (tidal deformity) will be detected, while for larger NS there will be more deformation detected in the GW signal. This gravitational tidal deformation analysis also gives us a rough idea of their internal composition and structure, including evidence allowing the core to exist as a quark-gluon-plasma, (see below). The GW ringdown signal and any kilonova afterwards can also give us valuable information about their interiors. It is currently believed from this GW analysis that the maximum mass of a NS is about 2 solar masses, although it is probable that a hyper massive NS may exist for a very brief time, (milli seconds to a few seconds) during a NS-NS merger and be about 2.5-3 solar masses, prior to collapsing further into a BH.

Collider Data

The modern relativistic heavy ion collider, (using a heavy nucleus) collision experiments, (RHIC) and the LHC experiments have given us a glimpse into the states of matter that may exist in the interior of NS and also in the early stages of the big-bang. These experiments and the corresponding theories rely heavily on quantum chromo dynamics or QCD, which is primarily the study of the strong nuclear force, mediated by gluons between quarks, (hadrons). QCD is also needed to discuss how "liberated" quarks and gluons interact in the quark-gluon plasma (QGP), that is believed to exist inside NS and has been successful in modeling and explaining such interactions. Remember that the quarks and gluons are almost massless but the hadrons are considered massive and form almost all the visible mass in our universe. In addition, the QGP state is considered by many to be a new form of matter.

In these collider experiments the relativistic interacting particles, (or nuclei) first collide, while experiencing quantum fluctuations, they then form an initial energy density "blob" which becomes a QGP with many degrees of freedom, (basically being able to form any variety of particles-sort of like nuclear stem cells), this QGP then evolves into hadrons and experiences a cool down or "freeze out" into particles that our detectors can detect. These particles are relativistic because they are accelerated to over 99.9999% the speed of light. Interestingly enough the QGP seems to behave like an almost perfect fluid, yet reaches temperatures of about 10^{12} K, (much hotter than the core of a NS!) and lasts for only about 10 femtoseconds! This cooler QGP is what theorists believe resembles the interior of a NS, (and perhaps the early moments of the BB). Unlike a NS where the event happens only once, here on earth we can generate these collisions as many times as we wish for study. These fluid like, complex body QGP systems, have an emergent property that we call a NS interior. The "freezeout" from the QGP into particles is believed to resemble the structure of the NS as we head out of the interior thru the various matter/particle transitions to the surface of the NS where the particles may form nuclei.

It turns out that the suspected density of matter in the interior of NS also closely resembles the density of the material produced in the proton-proton collisions at the LHC. This goes all the way down to the density of nuclear matter, (the nucleus) which is about 10^{14} g/cm^3. However, in the center of a NS the density is thought to be even higher as we mentioned, and currently we have no clear idea as to what this means. It could be just a mass of quarks or other strange and exotic matter. Beyond this density we come to black holes.

There has also been some thought that in the deep interior of NS there may exist exotic particles such as four, (tetraquark) and five, (pentaquark) quark "particles" or states, since these new quark states have been detected at the LHC, (the pentaquark in 2015 for example) although they rapidly decay and their lifetimes are extremely short. We also do not know exactly how such exotic quark states or strange hadrons can arise or exactly what their structure is. Remember that a meson is a two quark state, a hadron, (protons and neutrons) are a three quark state, and an isolated quark is thought to not be able to be detectable or even exist for any length of time. Who knows what is really in the cores of these incredibly dense objects!

The Core and Structure of Neutron Stars Part 1

by Henry De Jonge IV (September 2020)

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There is a lot of ongoing research into these relatively new areas of physics which include things like quarks in magnetic fields, (may be related to magnetars), and QCD which may explain phase transitions in NS that can shed light on the very early big bang. We have just begun and it is exciting to think of the new discoveries regarding NS, the BB, and many other areas in cosmology and particle physics when the LHC begins operating at even higher energies.

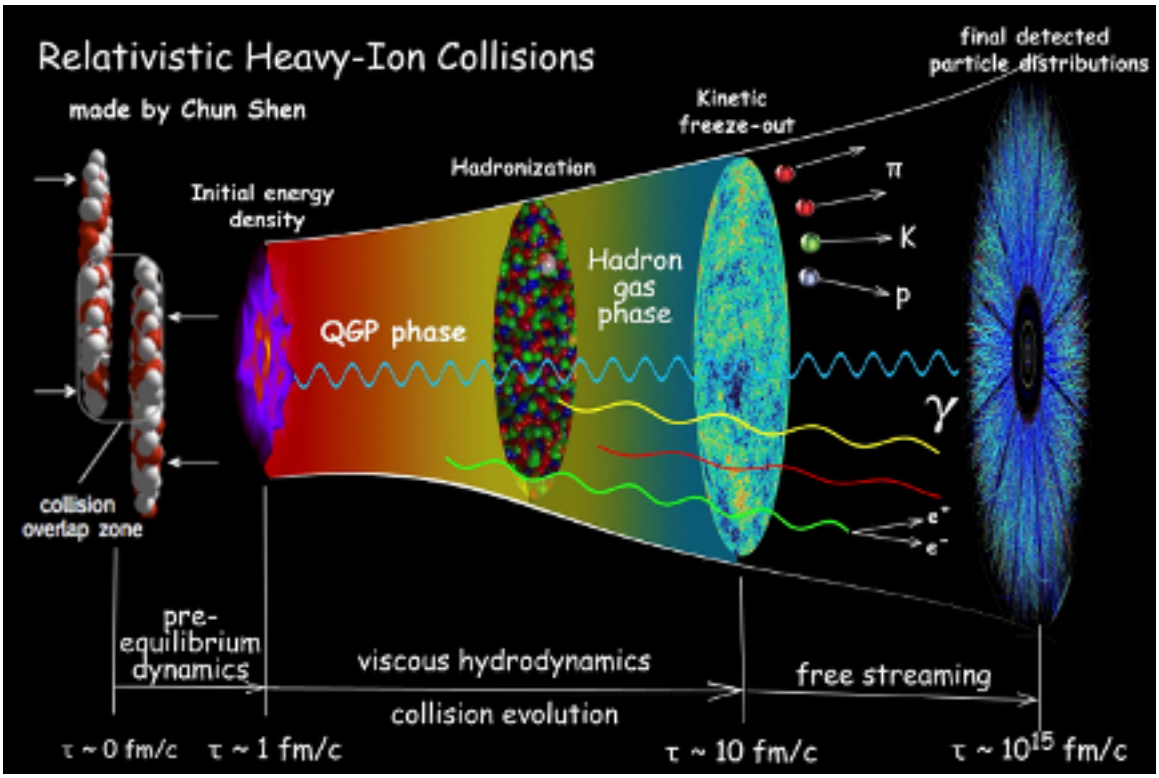

Figure 2. RHIC schematic as it relates to NS interior

The Equation of State

The GW signals and the results from repeatable collider experiments gives us a better model for understanding the "equation of state" or EoS of the NS and its various layers. The EoS is a key for predicting other physics such as properties during mergers and in the GW signals. Thus, a very important property of NS is the determination of the EoS, which is basically the relationship between the energy density and pressure of the NS. The EoS is a critical equation for understanding the NS, its layers, and core. For example, each NS with its unique EoS has a maximum mass that is dependent upon the microstructure. The EoS also gives us a relationship between the mass and the radius of the NS.

As we discussed earlier, in the aftermath of colliding two protons at nearly light speed at the LHC, the detections and modeling show that after about 1 femto second the smashed protons go thru a quark-gluon-plasma phase, and in about 10 femto seconds they enter into a hadron gas phase which goes thru a freezeout and then become the final particles that we can detect with the detectors, (all in less than a second or so). It turns out that the QGP phase and the hadron gas phase are best modeled with hydrodynamics and treat the phases as a fluid state with an appropriate EoS. It appears that currently these states provide some of the best analogies with the interior structures of NS with the density and pressure increasing as we go deeper into the NS. These states are again each modeled with the EoS. Any EoS must satisfy what we already know about NS such as the mass-radius relationship that is well grounded in observations. There are also many other modeling parameters and equations that any EoS needs to fulfill. Nonetheless they are very complicated and it is not easy to include all the various structures and states that a NS is thought to possess. Typically, each layer of a NS has its own EoS. Hadrons and quarks for example do not share the same EoS.

The Core and Structure of Neutron Stars Part 1

by Henry De Jonge IV (September 2020)

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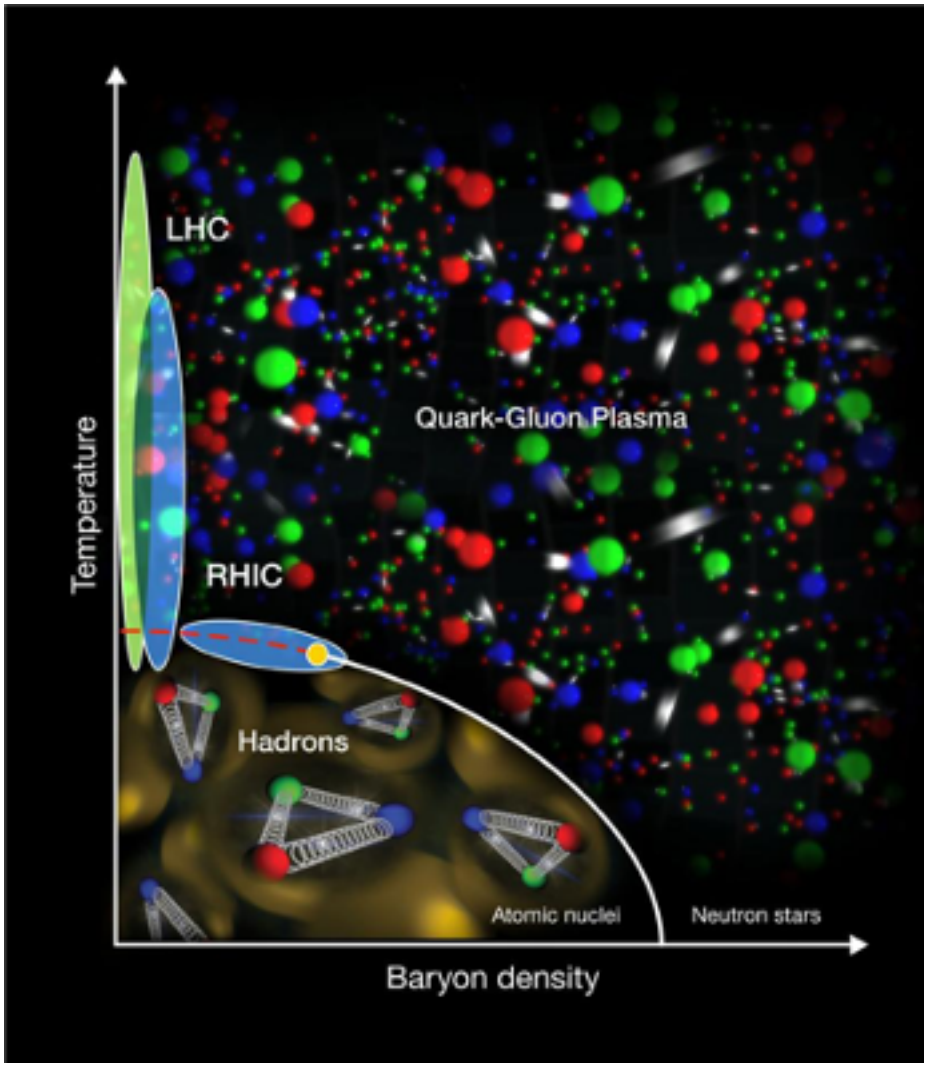

Figure 3. Artistic plot of NS EoS

In the second part of this article next month, we will discuss NS magnetic fields, their interior layers, core, and the future possibilities for continuing our understanding of these enigmatic and beautiful objects.

Find Out What's Happening – Join EVAC-Announce List

If you would like to receive email announcements about EVAC meetings and activities, please join the EVAC–Announce mailing list. Click on the link below to subscribe. Enter your full email address in the box titled User Options and press OK. You will receive a confirmation email. Your privacy is respected by EVAC and we will never sell your email address, or use it for non-club relevant solicitations. This mailing list is designed for communication from EVAC, and does not enable users to respond to the message. If you wish to contact club officers, please use the list in the Contact-Us area on the Home page of our EVAC website. To subscribe to the EVAC–Announce mail group click: http://www.freelists.org/list/evac-announce. To unsubscribe use the same link, enter your email address and select Unsubscribe from the "Choose An Action" list. Another list to consder is AZ-Observing@groups.io, simply click on this link https://groups.io/g/AZ-Observing and follow the instructions on the page. EVAC also has a Facebook Group where members may share ideas, photos, and Astronomy related information. To join: EVAC Facebook Group.

The Gilbert Rotary Centennial Observatory (GRCO) also has a Facebook Group where members may share ideas, photos, and Astronomy related information. To visit, please click on Gilbert Rotary Centennial Observatory - GRCO.

Looking for that perfect weekend activity?

Why not resolve to getting involved?

Contact Claude Haynes to join the staff at GRCO

Email: grco@evaconline.org

EVAC Outreach Events
by Gordon Rosner

Again, unfortunately another very short column this month as all outreach events remain on hold due to supporting the public health concerns. For more information, see the President's column at the beginning of this newsletter or at the top of the EVAC website.

As always, still looking very forward to our outreach program getting back and to hearing all those "OH WOW's" we so love to hear.

Gordon Rosner
EVAC Outreach Events Coordinator

Full Moon on September 1 at 10:22

Last Quarter Moon on September 10 at 02:26

New Moon on September 17 at 04:00

First Quarter Moon on September 23 at 18:55

Classified Ads

Classified Ads

The darkest, most Pristine, sky in the continental U.S. !

At the site: Bathroom facilities, running water, 5 pads w110v, wifi, acres of grassy camp sites.

From the site: Very Large Array 42mi E, The Astronomical Lyceum 55mi E, MRO Observatory 80mi E

IC 405

Insight Observatory
16" ATEO 1 Telescope

SkyPi Remote Observatory

Monthly Meetings will be presented live online using Zoom. See the EVAC Website for updates. All other events are on hold until health concerns are resolved.

The monthly general meeting is your chance to find out what other club members are up to, learn about upcoming club events and listen to presentations by professional and well-known amateur astronomers.

Our meetings are held on the third Friday of each month at the Southeast Regional Library in Gilbert. The library is located at 775 N. Greenfield Road; on the southeast corner of Greenfield and Guadalupe Roads. Meetings begin at 7:30 pm.

Visitors are always welcome!

Southeast Regional Library
775 N. Greenfield Road
Gilbert, Az. 85234

September 2020

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	**18**	19
20	21	22	23	24	25	26
27	28	29	30			

September 18 - EVAC Monthly Meeting Live

Online via Zoom

***The EVAC Monthly Meeting will be held live online via Zoom. All other meetings and events have been cancelled until further notice.**

October 2020

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	**23**	24
25	26	27	28	29	30	31

October 23- EVAC Monthly Meeting Live

Online via Zoom

***The EVAC Monthly Meeting will be held live online via Zoom. All other meetings and events have been cancelled until further notice.**

East Valley Astronomy Club -- 2020 Membership Form.

IMPORTANT: All memberships expire on December 31 of each year

New Member Dues (select according to the month you are joining the club)

	Individual	Family	
January, Feburary & March	**$30.00**	**$35.00**	
April, May & June	**$22.50**	**$26.25**	
July, August & September	**$15.00**	**$17.50**	
October, November & December	**$37.50**	**$43.75**	*(Includes following year)*

Renewal (current members only):

☐ **$30.00 Individual** ☐ **$35.00 Family**

☐ **Astronomical League:** $7.50 Annually (per person)

Name Badges: Quantity: _____

☐ **$10.00** Each

Name to imprint: _____

Total amount enclosed: ☐

Please make check or money order payable to EVAC

Payment will be made using PayPal ☐

Name: ☐ Phone: ☐

Address: ☐ Email: ☐

City State Zip ☐ URL For website ☐

Would you be interested in our outreach program? ☐ Yes ☐ No

How did you discover East Valley Astronomy Club? ☐

Liability Release Form

In consideration of attending any publicized Star Party hosted by the East Valley Astronomy Club (hereinafter referred to as "EVAC"), the receipt and sufficiency of which is hereby acknowledged, I hereby affirm that I and any related entities, predecessors, successors, affiliates, attorneys, guarantors, insurers, transferees, assigns, parents, spouses, children, subsidiaries, accountants, officers, directors, employees, agents, shareholders, members, and trustees, past and present, hereby forever release, acquit and discharge to hold EVAC and its related entities, predecessors, successors, affiliates, attorneys, guarantors, insurers, transferees, assigns, parents, spouses, subsidiaries, accountants, officers, directors, employees, agents, shareholders, members, and trustees, past and present, from any and all causes of action, claims, losses, damages, liabilities, expenses (including attorneys' fees) and demands of any nature whatsoever, known or unknown, that in any way relate to, arise out of, or concern EVAC and/or my presence on the premises of any EVAC Star Party and related areas, whether or not those causes of action, claims, damages, liabilities, and demands are part of the specific subject matter of EVAC or any EVAC Star Party. This release is intended to and does cover all injuries and damages, and the consequences thereof, whether known or unknown at the time of the execution of this release, which have occurred or may hereafter occur or which may hereafter be discovered, and which may have been caused or may be claimed to have been caused by the said incident, and specifically includes, but is not limited to, bodily injuries, mental and emotional injury, pain and suffering, medical treatments, and loss of earnings or income.

My signature upon this form also indicates agreement and acceptance on behalf of all minor children (under 18 years of age) under my care in attendance. EVAC only recognizes those who are members or invitees and who also have a signed Liability Release Form on file as participants at an EVAC Star Party.

Signature _____ Date _____

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www.evaconline.org

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