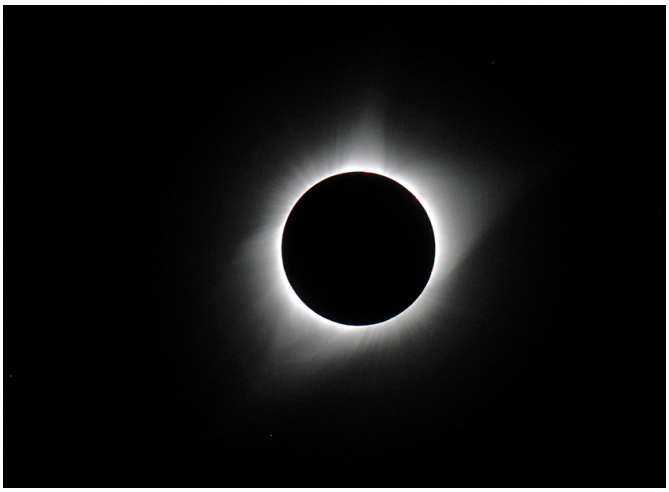
Temecula Valley Astronomer

The monthly newsletter of the Temecula Valley Astronomers Sep 2017

Events:

General Meeting : No general meeting this month. Check your TVA email for details about a possible star party at our future dark sky site.

For the latest on Star Parties, check the web page.



2017 Solar Eclipse. Credit: Steve Thornton. Location: Agate Fossil National Monument, NB. Equipment: Nikon D300, 80-200, f/2.8 Nikkor & 1.4x teleconverter

WHAT'S INSIDE THIS MONTH:

Send newsletter submissions to Mark DiVecchio <markd@silogic.com> by the 20th of the month for the next month's issue.

Like us on Facebook

General information:
Subscription to the TVA is included in the annual $25 membership (regular members) donation ($9 student; $35 family).

President: Mark Baker 951-691-0101
<shknbk13@hotmail.com>
Vice President: Skip Southwick
<skipsouthwick@yahoo.com>
Past President: John Garrett <garrjohn@gmail.com>
Treasurer: Curtis Croulet <calypte@verizon.net>
Secretary: Deborah Cheong <geedeb@gmail.com>
Club Librarian: Bob Leffler <bobjleffler@msn.com>
Facebook: Tim Deardorff <tim-deardorff@yahoo.com>
Star Party Coordinator and Outreach: Deborah Cheong
<geedeb@gmail.com>

Address renewals or other correspondence to:
Temecula Valley Astronomers
PO Box 1292
Murrieta, CA 92564

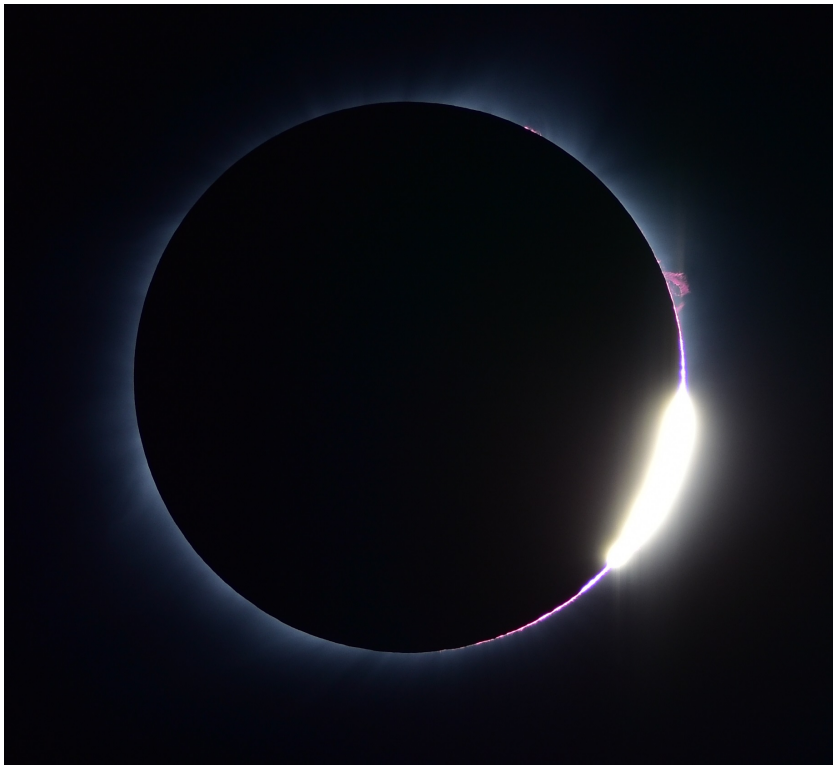
Member's Mailing List: tvastronomers@googlegroups.com
Website: http://www.temeculavalleyastronomers.com/

Cosmic Comments – Sep/2017

by President Mark Baker

Thoughts from Down Under...one thing I've discovered is that Astronomy enthusiasts are pretty much the same worldwide. We love to talk skies...!!! In my case, since I was under totally foreign skies, I loved to listen. Perth is about 36 degrees S latitude as compared to our 33 degrees N, so the views were either new, or upside down!! The first thing I noticed, even under dark skies, was that there are far fewer observable objects as compared to our NH sky. But the Perther's know them well... The Perth Observatory has a long, centuries old history. It started out as the official timekeeper for W Australia by way of astronomical observations and through "pulses" transmitted via land lines throughout the region. Somewhere along the line, the government lost interest in the facility, it fell into disrepair, and has been resurrected by a group of volunteers ad become a popular public venue. I think all of you would appreciate the "ancient" equipment that they have available, and that it all works!! They even have a scope on loan from the Lowell Observatory in the tall dome for research. For more details, look up the observatory on Google... Such experiences only serve to enhance my appreciation for what we all do in the name of science and Astronomy, whether Down Under or Up above!!

Clear, Dark Skies my Friends…



2017 Solar Eclipse. Credit: Jim Mettler. Location: Oregon Star Party

Looking Up – Sep 2017
by Curtis Croulet

Full Moon is September 6 at 12:03 AM PDT; **Last Quarter Moon** is September 12 at 11:25 PM PDT; **New Moon** is September 19 at 10:30 PM PDT; **First Quarter Moon** is September 27 at 7:53 PM PDT.

Mercury makes an appearance in the morning sky in mid-September. Greatest angular distance from the Sun is September 12. On September 16 Mercury is very close to Mars. Mercury is much the brighter of the two. Mercury is too close to the Sun to observe by the end of the month.

Venus continues in the pre-dawn sky. It remains at mag -3.9.

Mars is also in the pre-dawn sky. The God of War is quite low as the sky rapidly brightens. As mentioned in connection with Mercury, Mars closely approaches the messenger planet on September 16.

Jupiter is heading for the last roundup. It's in the southwestern sky in early September, and it sets as early as 7:30 PM by month's end.

Saturn, which we greeted with such great excitement in June, is already setting before midnight. It sets around 10:30 PM at month's end.

As we lose the gas giants, we are gaining the ice giants. **Uranus** is in Pisces, rising by 7:20 PM at the end of September. **Neptune** precedes Uranus in Aquarius. Opposition for Neptune is September 4.

Pluto is in northeastern Sagittarius. It transits the meridian early in the evening. To see it, you need a big scope and a dark sky. Even so equipped, your biggest problem isn't seeing Pluto, it's identifying it. The July 2017 issue of *Sky & Telescope* has a detailed finder chart for the dwarf planet on pp.48-49.

We have three very sparse meteor showers in September: the **September Epsilon Perseids**, which run from September 5 through 28, peaking on September 9; the **Southern Taurids**, which run from September 7 into November, peaking on October 10; and the **Epsilon Geminids**, which run from September 29 into early November, peaking on October 18. You may not be able to distinguish the meteors in these showers from ordinary erratic meteors unless you plot their paths on a chart.

Let's look up.

Cygnus the swan lies almost directly overhead on September evenings. Because of its superb viewing position for Northern Hemisphere observers, and also because of its location in a rich section of the Milky Way, Cygnus is a perennial late-summer favorite of amateur astronomers. In the *Almagest*, that ancient compendium of scientific knowledge compiled by the Alexandrian astronomer Ptolemy in the Second Century AD, this star pattern is a swan. That's how it came

down to us as one of the standard constellations. Although many ancient cultures viewed it as a bird, it was not always a swan. The classic *Burnham's Celestial Handbook*, by Robert Burnham Jr., says this star pattern was sometimes seen as an eagle, a hen, or a partridge. In light-polluted skies, only the brightest stars of Cygnus are visible. It's often seen as the "Northern Cross." In December the setting cross stands almost vertical near the western horizon. In darker skies, the great wings of the swan are seen to extend well beyond the arms of the cross.

At the northern end of the Northern Cross is the star Deneb, twentieth brightest star in the night sky and the northern member of the "Summer Triangle," which includes Vega and Altair. You may recall that there are other Denebs in the sky: Denebola in Leo and Deneb Kaitos in Cetus. The name Deneb derives from the Arabic *Al Dhanab*, which simply means "tail" – as in the tail of the lion (Denebola) and tail of the sea monster (Deneb Kaitos).

To us Deneb is distinctly fainter than nearby Vega, fifth brightest star in the night sky. But Vega is brighter because it's much closer to us: 25 light years compared to 3,000 light years for Deneb. Deneb is much more massive than Vega and intrinsically much brighter. If these two stars were placed at a standard distance of 10 parsecs (32.616 light years), then we would see Vega at magnitude 0.58, while Deneb would be a vastly brighter at -8.73. It would dominate the summer sky.

Cygnus has a wealth of objects visible in amateur telescopes. One of the favorite double stars is Alberio, which marks the head of the swan or southern end of the cross. Alberio's two components are easily split at low magnifications such as 40x. Their colors are a contrasting blue and yellow. Alberio may be only a chance alignment of unrelated stars rather than a true binary.

Northeast of Deneb is the great North America Nebula, one of the most spectacular diffuse nebulae in the northern sky. The nebula is invisible in a light-polluted sky, even in a telescope, but in a dark sky it verges on naked-eye visibility. Ordinary birding binoculars will show its nebulosity without a distinctive shape. In an 8-inch telescope, "Mexico" and the "Gulf of Mexico" are discernible.

Elsewhere in Cygnus are several planetary nebulae and the interesting (photographically) Crescent Nebula. I should point out that planetary nebulae have no relationship to planets other than that some of them looked like distant planets to William Herschel. They are shells of glowing gas expelled by dying stars. Some planetary nebulae are visible in telescopes in suburban skies. They look like tiny, bluish-green disks. The three parts of the Veil Nebula hang off the eastern arm of the cross. The curving easternmost part of the Veil, sometimes separately called the Network Nebula, can even be seen in binoculars – in a very dark sky. The Veil is the dissipating remnant of a supernova from several thousand years ago. Among the best open clusters in Cygnus are M29 and M39. Cygnus is devoid of globular clusters and bright galaxies. A good printed star atlas like *Sky Atlas 2000.0* will show many objects in Cygnus which are observable in modest amateur telescopes.

Clear skies.

Random Thoughts
by Chuck Dyson

THE SOLAR MARS CONNECTION

At the TVA meeting in August Mark Baker was reviewing some of the recent data on Mars from NASA on the amount and location of water on Mars. During his talk Mark mentioned that NASA has discovered new underground glaciers with enough water to cover the entire planet with one meter of water and as Mars has a surface area of 144,800,000 square kilometers this represents a fair amount of water, but wait there is more, much more; if one adds in all of the other confirmed and suspected water the estimates go from a water blanket of 36 meters to a whopping 1,000 meters covering Mars. Now this should make Mars a water planet, right? To get a little greater perspective let's look at Earth and Earth has a surface area of 510,000,000 square kilometers and if all of our known water was on the surface the water blanket would be from 2,600 to over 3,000 meters deep. All of a sudden Mars doesn't look so wet anymore and that leads us to ask the questions was Mars ever wet and if it was where did the water go and how did it go?

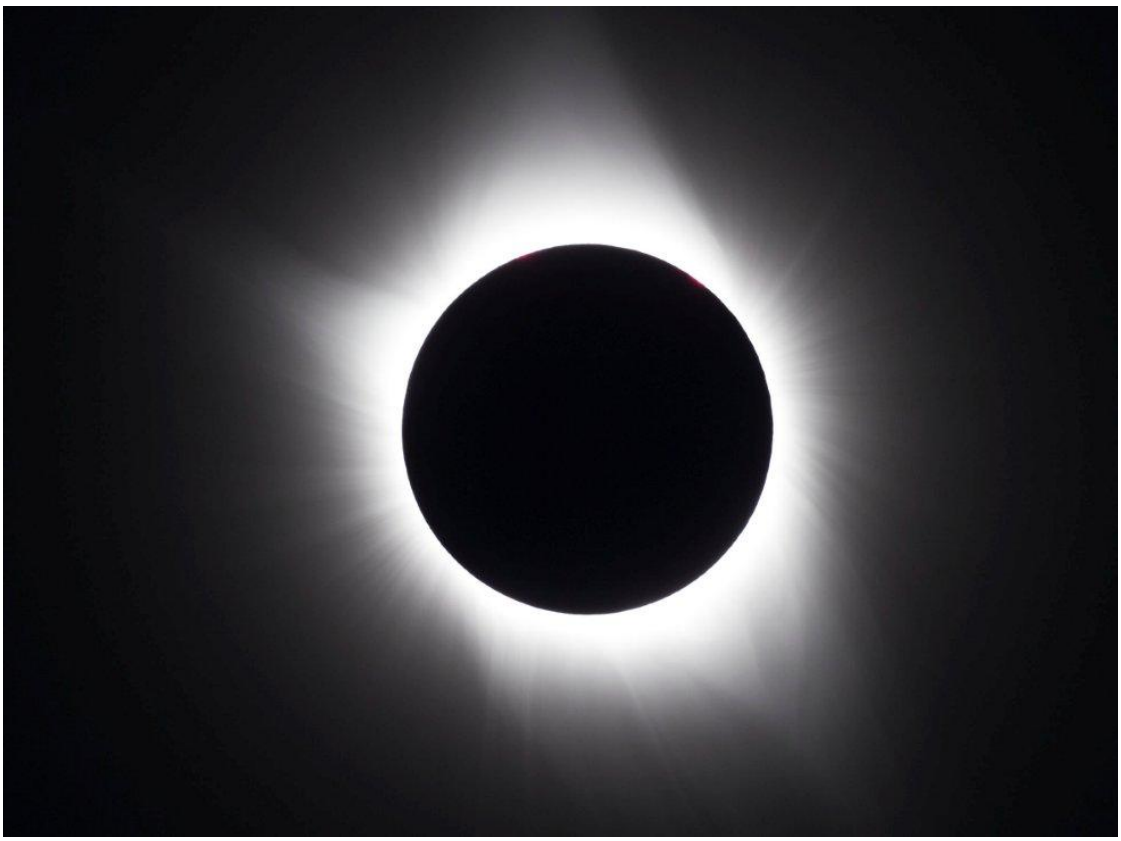
Thanks to the rovers Spirit, Opportunity, and Curiosity and a bunch of very high resolution photographs we now have good reason to believe that Mars was much wetter in the past as to where did the planetary water come from, well that is still up for discussion; how much water did each planet get, more discussion. Where did the water go?

Now we are getting somewhere because we know that a lot of it went into space. How did it get into space? Enter a bright young lad from Cambridge University, Sir James Jeans, father of the Jeans escape. We should note that Jeans wrote his paper describing, accurately, the mechanisms by which gasses escaped Earth's gravity in 1916 that is about 30 years before the first sounding rockets were sent up to the regions he was describing to find out what was actually going on there.

In Jeans escape, although atoms and molecules have an average amount of energy for any given temperature, not all atoms and molecules have the same energy, some have more and some have less. If an atom/molecule with really high energy smacks another atom/molecule, especially a lighter one, at the very edge of space, then there is a very good chance that that atom/molecule will reach escape velocity and not hit another atom/molecule and go off into space and be lost to the Earth forever. Satellites around Earth and other planets have verified that Jeans escape works exactly as Jeans said it would the only problem is that it works very slowly and if it were the only way Mars had lost its water then Mars would be much wetter than it is today. Fear not, help is on its way to strop Mars of its water. When Jeans did his work he assumed that a planet's atmosphere was static or non-moving and this is just not so. If the atmosphere is moving then it can give a boost to the motion of atoms/molecules and this greatly increases the rate at which elements of a planet's atmosphere is lost. This method of atmospheric loss is called hydrodynamic escape and it also has been confirmed by satellites to be a source of atmospheric loss in planets. Yet another proven way that planets can lose their atmosphere is through the process of sputtering. In sputtering a planet with no magnetic field around it has its atmosphere greatly warmed by intense solar radiation and the atmosphere

expands so fast and so far that entire layers are stripped off by the solar winds. Sputtering is now thought to be one of the major ways Mars has lost its water over billions of years. The final way that Mars could have lost some of its water and the reason I say could have is because no one seems t now how a great an impact this method could have had on Mars is the literal impact of meteorites and asteroids on Mars. On Earth we have samples of meteorites from Ceres, the Moon, and Mars and it only stands to reason that if rocks can be accelerated to escape velocity by an impactor then the impacted bodies atmosphere cannot be far behind the big question of the day is “how much atmosphere is lost this way?”. The real question is not did Mars lose most of its atmosphere but if we do not change anything about Mars except to warm it up and pump more water vapor into its atmosphere what is to keep the forces that we now know are stripping Mars of its atmosphere from removing the last of its water and forever turning it into a dead dry rock?

Cheers
Chuck



2017 Solar Eclipse. Credit: Curtis Croulet. Location: Menan, ID. Canon 6D DSLR & TeleVue NP101is refractor.

Something Wicked This Way Went – Part III
by Clark Williams

So what can we do about falling rocks? Quite a lot actually. As Larry Niven pointed out: “The dinosaurs became extinct because they didn't have a space program. And if we become extinct because we don't have a space program, it'll serve us right!” We do have a space program!

Most of the “Hollywood” solutions involve blowing up the asteroid or drilling in a messy tangle of frost encrusted spikes. Take all of the Hollywood solutions and just throw them into the chest of suspended-disbelief. Then, just walk away.

Planetary defense is essentially broken into two types: 1) Pulverize it to tiny enough pieces that the natural earth defenses can cope. 2) Push it into a new orbit (AKA: defer or delay).

Pulverizing:

Pulverizing an asteroid is not a great idea without some control. If you splinter an asteroid into giant pieces you're just asking for more detritus and multiple fireballs instead of one. This just makes the problem worse. If you can guarantee that the pieces are say a meter or less in diameter you can probably handle the aftermath of impact. Here is the output from the Imperial College London /Purdue University Earth Impact Effects Program by Robert Marcus, H. Jay Melosh and Gareth Collins for a 1 meter diameter asteroid striking rock at a 90° angle. if you are within ½ kilometer of ground zero:

Distance from Impact: 500.00 meters (≈ 1640.00 feet)
Projectile diameter: 1.00 meters (≈ 3.28 feet)
Projectile Density: 8,000 kg/m3
Impact Velocity: 24.00 km per second (≈ 14.90 miles per second)
Impact Angle: 90 degrees
Target Density: 2,750 kg/m3
Target Type: Crystalline Rock
Energy before atmospheric entry: 1.21×10^{12} Joules = 0.29×10^{-3} Megatons TNT
The average interval between impacts of this size somewhere on Earth is 0.2 years. The Earth is not strongly disturbed by the impact and loses negligible mass. The impact does not make a noticeable change in the tilt of Earth's axis (< 5 hundredths of a degree). The impact does not shift the Earth's orbit noticeably. The projectile begins to breakup at an altitude of 18,600 meters = 61,000 ft. The projectile bursts into a cloud of fragments at an altitude of 17,200 meters ≈ 56,600 ft. The residual velocity of the projectile fragments after the burst is 13 kps = 8.08 mps. The energy of the airburst is 8.52×10^{11} Joules = 0.20×10^{-3} Megatons. Large fragments strike the surface and may create a crater strewn field. A more careful treatment of atmospheric entry is required to accurately estimate the size-frequency distribution of meteor fragments and predict the number and size of craters formed.
Air Burst: The air blast at this location would not be noticed. (The overpressure is less than 1 Pa)

As you can see this is not too bad. Increase to 5 meters or even 10 and things don't worsen appreciably. Fifteen meters is beginning to be a problem. Add one more meter and you are in trouble:
The air blast will arrive approximately 15.3 seconds after impact.
Peak Overpressure: 28200 Pa = 0.282 bars = 4 psi
Max wind velocity: 59.6 m/s = 133 mph
Sound Intensity: 89 dB (Loud as heavy traffic)
Damage Description:

- Wood frame buildings will almost completely collapse.
- Glass windows will shatter.
- About 30 percent of trees blown down; remainder have some branches and leaves blown off.

All of these figures are of course WAGs and SWAGs. We don't know as much as we need to know to get nickel-iron-solid numbers but even these numbers are disturbing enough to make further research important.

Delay or Defer:

The Earth is traveling about 30 kps (18.6 mps) in its orbit around the sun. Earth is approximately 12,750 km (7,923 mi) in diameter which means that the Earth travels a distance of one planetary diameter about every 425 seconds (7min 5 seconds). If you can impede the asteroid for 425 seconds, you could miss the planet or perhaps ensure a watery impact.

So what are some of the ideas that people have come up with to pulverize, push, delay and defer these mountainous beasties?

LASER Bees:

Of the proposals for planetary protection so far one proposal offers a two punch push-and-pulverize approach that is pretty interesting. It is called “LASER Bees”.

LASERs have a healthy punch especially when applied over time. There are many different kinds of LASERs. They all give a particular punch dependent generally on the input power. More power in, more power out.

One type of LASER, the CO_2 LASER can increases its power by lengthening the tube. It still follows the basic directly-proportional rule of more power in, more power out and is tunable by lengthening the tube. You can apply push over time as well as ablating some of the asteroid in controlled bursts creating accelerated redistribution of the orbital energy (you pushed the asteroid into a new orbit).

Put up a swarm of small satellites around the asteroid and you may effect a large change in a short time. The “LASER Bees” would be fairly cheap and easy to build would be semi-autonomous and could be delivered in a multiple satellite delivery vehicle. Very COOL!

LASER Bees doesn't use CO_2 LASERs; it proposes the use of a different type of LASER. But the tunable idea is similar.

Currently this is one of the proposals from the University of Strathclyde in Scotland supported in part by a grant from the Planetary Society.

Ion Beam Shepherd:

Another "contactless" asteroid deflection technique has been recently proposed by C.Bombardelli and J.Peláez from the Technical University of Madrid called Ion Beam Shepherd. The method involves the use of a low divergence ion thruster pointed at the asteroid from a nearby hovering spacecraft. The momentum transmitted by the ions reaching the asteroid surface produces a slow but continuous force that can deflect the asteroid in a similar way as done by the gravity tractor but with a lighter spacecraft.

Mass Driver:

A mass driver is an (automated) system on the asteroid to eject material into space thus giving the object a slow steady push and decreasing its mass. A mass driver is designed to work as a very low specific impulse system, which in general uses a lot of propellant, but very little power.

The idea is that when using local material as propellant, the amount of propellant is not as important as the amount of power, which is likely to be limited.

Another possibility is to use a mass driver on the Moon aimed at the NEO to take advantage of the Moon's orbital velocity and inexhaustible supply of "rock bullets”.

Conventional Rocket Engine:

Attaching any spacecraft propulsion device would have a similar effect of giving a steady push, possibly forcing the asteroid onto a trajectory that takes it away from Earth.

An in-space rocket engine that is capable of imparting an impulse of 10^6 N s (eg adding 1 km/s to a 1000 kg vehicle), will have a relatively small effect on a relatively small asteroid that has a mass of roughly a million times more.

Chapman, Durda, and Gold's white paper calculates deflections using existing chemical rockets delivered to the asteroid.

Other Proposals:

Wrapping the asteroid in a sheet of reflective plastic such as aluminized PET film and using it that as a solar sail.

"Painting" or dusting the object with titanium dioxide (white) to alter its trajectory via increased reflected radiation pressure or with soot (black) to alter its trajectory via the Yarkovsky effect.

Planetary scientist Eugene Shoemaker in 1996 proposed deflecting a potential impactor by releasing a cloud of steam in the path of the object, hopefully gently slowing it. Nick Szabo in 1990 sketched a similar idea, "cometary aerobraking", the targeting of a comet or ice construct at an asteroid, then vaporizing the ice with nuclear explosives to form a temporary atmosphere in the path of the asteroid.

Attaching a tether and ballast mass to the asteroid to alter its trajectory by changing its center of mass.

Magnetic Flux Compression to magnetically brake and or capture objects that contain a high percentage of meteoric iron by deploying a wide coil of wire in its orbital path and when it passes through, Inductance creates an electromagnet solenoid braking the object.

Further Reading:

If you are interested in doing your own asteroid impact estimates or interested in the math behind the program used to generate the data used here refer to the following two links:

Earth Impact Effects Program: http://impact.ese.ic.ac.uk/ImpactEffects/
Math: http://impact.ese.ic.ac.uk/ImpactEffects/effects.pdf

I warn you now, this Web site is addictive.

Bibliography (Abbreviated):
Asteroid Impact Avoidance:
https://en.wikipedia.org/wiki/Asteroid_impact_avoidance

Laser Bees Update:
http://www.planetary.org/blogs/bruce-betts/20131029-laser-bees-update.html

Barringer Crater:
https://en.wikipedia.org/wiki/Meteor_Crater
http://meteorcrater.com
Bad Astronomy:
http://www.badastronomy.com/index.html
“Bad Astronomy”, by Philip C. Plait, Published by John Wyle & Sons, Inc., New York, ISBN-13: 978-0471409762 & ISBN-10: 0471409766 – (Kindle Edition)

Kirkwood gap:
https://en.wikipedia.org/wiki/Kirkwood_gap

Asteroid Belt:
https://www.universetoday.com/130136/far-asteroid-belt-earth/
https://en.wikipedia.org/wiki/Asteroid_belt
https://www.space.com/16105-asteroid-belt.html
https://solarsystem.nasa.gov/planets/asteroids/indepth
http://space-facts.com/asteroid-belt/

Chicxulub Crater:
https://en.wikipedia.org/wiki/Chicxulub_crater
http://onlinelibrary.wiley.com/doi/10.1029/2001JE001532/abstract
http://www.sciencemag.org/news/2016/11/update-drilling-dinosaur-killing-impact-crater-explains-buried-circular-hills
http://news.nationalgeographic.com/2016/06/what-happened-day-dinosaurs-died-chicxulub-drilling-asteroid-science/

Asteroid Impact Calculation Program:
Imperial College London/Purdue University Earth Impact Effects Program by Robert Marcus, H. Jay Melosh and Gareth Collins (WEB site in article)

Asteroid Impact Locations:
http://solarviews.com/eng/crater.htm

NASA SpacePlace

The article from NASA SpacePlace this month was about the eclipse. Since that will be over by the time this newsletter is published, we invite you to explore the Universe on your own at:

spaceplace.nasa.gov

This Article is provided by NASA Space Place.
With articles, activities, crafts, games, and lesson plans, NASA Space Place encourages everyone to get excited about science and technology.

*Visit **spaceplace.nasa.gov** to explore space and Earth science!*

The TVA is a member club of The Astronomical League.