WEYMOUTH ASTRONOMY

Sky Watcher

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Trips / Events

Ideas for trips and events always welcome!

events@weymouthastronomy.co.uk

- **20 May CADAS—Eclipses I have known—Chris Bowden**
- ***2 June WAS—Exhibition Evening***
- ***9 June BNSS—Journey to the Centre of the Earth—David Whitehouse***
- ***17 June CADAS—Antarctic Astrophysics—Gemma Lavender***
- ***7 July WAS—Impacts! - James Fradgley***
- ***4 Aug WAS—Dark Future—Bob Mizon***
- ***15 July CADAS—Ask the Experts Evening***
- ***19 Aug CADAS—Bob's Planetarium***
- ***1 Sept WAS—The Sky's Dark Labyrinth—Stuart Clark***
- ***16 Sept CADAS—Rocks from Space—Ron Westmaas***
- ***6 Oct WAS—AGM & Astronomers' Question Time***
- ***21 Oct CADAS—APOD Evening—Bob Mizon***

WAC Upcoming Events:

12 June—Seven Moons—Bob Mizon

10 July—Astrophotography—John Gifford

14 August—Public Open Evening

11 Sept—Eclipses I have known—Chris Bowden

9 Oct—Auroras on Earth and Beyond—Sheri Karl

More to come!

Plans for informal viewing nights will take place after the monthly meetings, weather permitting.

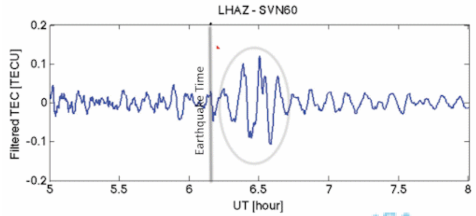
WAC News—

Interesting web find of the month: Earthquake detection in the ionosphere

The ionosphere is very sensitive to solar storms. Turns out, it can be sensitive to earthquakes, too. NASA is reporting that the magnitude 7.8 earthquake in Nepal on April 25th created waves of energy that penetrated the ionosphere and disturbed the distribution of electrons. Note the wave pattern, circled, in the upper panel of this ionospheric electron density plot:

Basically, these are waves of electron density rippling from a point in the ionosphere above the epicenter of the quake. The waves were measured by a science-quality GPS receiver in Lhasa, Tibet. It took about 21 minutes for the waves to travel 400 miles between the epicenter and the GPS receiving station.

Www.spaceweather.com on 2 May 2015



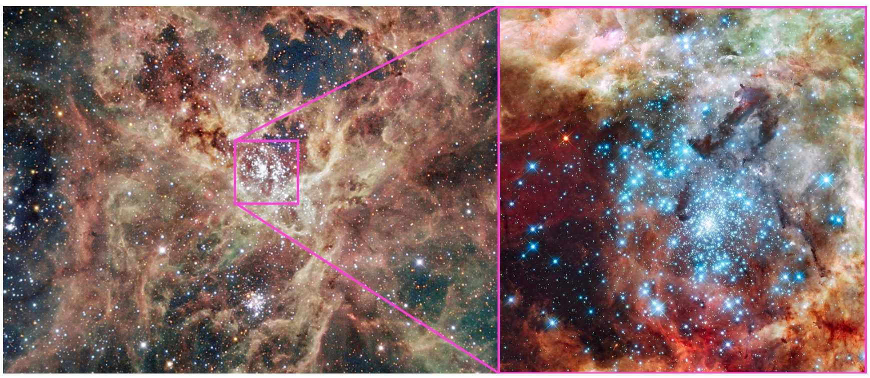
Until next month...clear skies! ~SK

Is the Most Massive Star Still Alive? By Dr. Ethan Siegel

The brilliant specks of light twinkling in the night sky, with more and more visible under darker skies and with larger telescope apertures, each have their own story to tell. In general, a star's color correlates very well with its mass and its total lifetime, with the bluest stars representing the hottest, most massive and *shortest-lived* stars in the universe. Even though they contain the most fuel overall, their cores achieve incredibly high temperatures, meaning they burn through their fuel the fastest, in only a few million years instead of roughly ten billion like our sun.

Because of this, it's only the youngest of all star clusters that contain the hottest, bluest stars, and so if we want to find the most massive stars in the universe, we have to look to the largest regions of space that are actively forming them right now. In our local group of galaxies, that region doesn't belong to the giants, the Milky Way or Andromeda, but to the Large Magellanic Cloud (LMC), a small, satellite galaxy (and fourth-largest in the local group) located 170,000 light years distant.

Despite containing only one percent of the mass of our galaxy, the LMC contains the Tarantula Nebula (30 Doradus), a star-forming nebula approximately 1,000 light years in size, or roughly seven percent of the galaxy itself. You'll have to be south of the Tropic of Cancer to observe it, but if you can locate it, its center contains the super star cluster NGC 2070, holding more than 500,000 unique stars, including many hundreds of spectacular, bright blue ones. With a maximum age of two million years,



Images credit: ESO/IDA/Danish 1.5 m/R. Gendler, C. C. Thöne, C. Féron, and J.-E. Ovaldsen (L), of the giant star-forming Tarantula Nebula in the Large Magellanic Cloud; NASA, ESA, and E. Sabbi (ESA/STScI), with acknowledgment to R. O'Connell (University of Virginia) and the Wide Field Camera 3 Science Oversight Committee (R), of the central merging star cluster NGC 2070, containing the enormous R136a1 at the center.

Star *(continued)*

the stars in this cluster are some of the youngest and most massive ever found.

At the center of NGC 2070 is a very compact concentration of stars known as R136, which is responsible for most of the light illuminating the entire Tarantula Nebula. Consisting of no less than 72 O-class and Wolf-Rayet stars within just 20 arc seconds of one another, the most massive is R136a1, with 260 times the sun's mass and a luminosity that outshines us by a factor of *seven million*. Since the light has to travel 170,000 light years to reach us, it's quite possible that this star has already died in a spectacular supernova, and might not even exist any longer! The next time you get a good glimpse of the southern skies, look for the most massive star in the universe, and ponder that it might not even still be alive.

Article of the Month—Members Section

Why can't objects travel faster than light?

In last month's 'ask the experts' meeting the above was one of the questions asked.

The answer given hinged on an explanation of the formula: $m = \frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}}$ where m_0 is the rest mass of the object m is its mass when it is travelling at speed v and c is the speed of light (three hundred million metres per second).

It was explained that, as the speed of the object approaches the speed of light, the formula implies m, the mass of the object, tends to get arbitrarily large and hence will resist any attempt to accelerate it to higher speed. Thus the speed of light is the limit to how fast it can go.

Although this explanation is correct within its context (i.e. if you assume the formula is true), as the formula was not explained, I offer the following as a reason why it is true:

Special Relativity can be thought of as a study of the geometry of space-time. It says that when an object is moving at a speed v with respect to a person at rest, its coordinates used to describe spatial extent and the flow of time appear, to the stationary observer, to undergo a transformation (called a Lorentz transformation) so that, in particular, the flow of time for the object appears slowed down. The object's clock 'ticks' (as seen by the stationary observer) at a slower rate of $\sqrt{1-\frac{v^2}{c^2}}$ times that of the stationary observer's clock. So as the speed of the object approaches c its ticks interval slows towards a stop.

Now, if the object is accelerating in its own reference frame, its local velocity is changing with respect to time (measured by its clock). But as its speed nears c its clock appears to have slowed almost to a stop when viewed by the stationary observer so the rate of change in velocity is almost zero (when measured by the stationary observer). [This fact alone explains the speed limit of c referred to by the above question.] The stationary observer knows that a force is being applied but the acceleration is less than that in the object's frame (a_0) by a factor of $\sqrt{1-\frac{v^2}{c^2}}$ because this is the factor that time is slowed by. The reason for this can be seen as follows: if the object were to report back to the stationary observer, its local velocity at each tick of its clock as well as the force applied, then these quantities would appear to the stationary observer to occur at intervals of $\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}$ times the time between the object's ticks. Hence the acceleration (change in velocity divided by time) appears to the stationary observer to be reduced by the factor described above i.e. $\sqrt{1-\frac{v^2}{c^2}}$.

Now force is defined as ma where a is acceleration and the force is a known fixed quantity. The acceleration has just been stated to be reduced (w.r.t. the stationary observer) by a factor of $\sqrt{1-\frac{v^2}{c^2}}$ so its mass must be increased by the reciprocal of this factor to make the force applied appear unchanged. We thus obtain the original expression above for mass: $m = \frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}}$ because the assumed force: $Force = ma = \left(\frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}}\right).\left(\sqrt{1-\frac{v^2}{c^2}}.a_0\right) = m_0 a_0$ does not change. This is ensured by the square root terms in the expression cancelling each other out and this is only possible if the mass increases with velocity as claimed.

Hence understanding why the mass of the speeding object appears to increase boils down to understanding the way that the object's time is 'slowed down' from the perspective of the stationary observer.

PV Masham FIMA

Next month is part two of this article series on 'Time Dilation' from WAC member P. Masham

Originally planned to orbit Mercury for one year, the mission exceeded all expectations, lasting for over four years and acquiring extensive datasets with its seven scientific instruments and radio science investigation. This afternoon, the spacecraft succumbed to the pull of solar gravity and impacted Mercury's surface. The image shown here is the last one acquired and transmitted back to Earth by the mission. The image is located within the floor of the 93-kilometer-diameter crater Jokai. The spacecraft struck the planet just north of Shakespeare basin.

As the first spacecraft ever to orbit Mercury, MESSENGER revolutionized our understanding of the solar system's innermost planet, as well as accomplished technological firsts that made the mission possible.

30 April 2015 Image Credit: NASA/Johns Hopkins University Applied Physics Laboratory/Carnegie Institution of Washington