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ASTRONOTES

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LHC Update

By Tracy McConnell, Education Support Officer

Following on from my article in the June 2010 edition of Astronotes, about the CERN institute and the LHC, I thought I'd include an update this month. With such an exciting, ground breaking experimental apparatus, there are bound to be new developments. So what's going on at the Large Hadron Collider now?

Well physicists at the LHC have observed candidates for the heaviest elementary particle known to science, top quarks. Several "possible detections" were made recently with the ATLAS and CMS experiments. However more data is needed to confirm the production of these particles at the LHC. Such a confirmation would be the first in Europe, since the particle's first discovery in 1995 by the Tevatron Accelerator at Fermilab, Fermi National Accelerator Laboratory in Chicago. The Tevatron is a 6.4 km (4 mile) ring capable of achieving 1TeV collisions (quite a bit smaller than the LHC). The top quark has never been discovered outside of this experiment, so for the LHC to detect them will be a huge accomplishment.

On 26 July 2010 spokespersons from the four major experiments at the LHC – ALICE, ATLAS, CMS and LHCb, presented the results that had been achieved to date, at ICHEP, the International Conference on High-Energy Physics, the world's largest international conference on particle physics, in Paris.

These measurements taken at 3.5 TeV per beam (an energy 3.5 times higher than previously achieved at a particle accelerator) start by rediscovering the particles essential to our current understanding of matter, the Standard Model. Once this familiar ground has been covered, the way is then clear for new discoveries.

Image Credit: www.fnal.com

Fermi National Accelerator Laboratory
The dual rings of the Fermilab accelerate subatomic particles to near light speed and scientists unravel the mysteries of the universe from beams of colliding particles. The lower ring injects particles into the main Tevatron accelerator.

CERN will run the LHC for 18 – 24 months, aiming to record enough data for each experiment to allow for advances in a wide range of physics investigations.

The top quark has never been discovered outside of the Tevatron experiment. There is thought to be a special interaction between the top quark and the Higgs-Boson, so confirming the detection of the top quark at the LHC will be a step closer to the coveted "God Particle".

The Moon and the Tides

By Sinead McNicholl, Education Support Officer

This summer, I'm sure most of us have walked along the sea-shore or even sat on the edge of a pier watching and listened to the tranquility of the ocean. If you sit for long enough you will notice that the levels of the sea rise and fall periodically. This change in the water level is called the tide. A tide is the regular and predictable movement of water caused by astronomical

phenomena. Tides are among the most reliable phenomena in the world as we are assured that the oceans will rise and fall each day. It is caused by the way the Earth, Moon and Sun move in relation to each other. Both the Moon and Sun affect the tides, however, the Moon has more than twice the effect of the Sun, even though it is much smaller. The reason for this is that the Moon is much closer to the Earth, approximately 240 000 miles (386 240 km), and thus it exerts a greater influence on the tides than the Sun does, which sits 93 million miles (150 million km) from the Earth. A simple explanation of why we have tides on Earth is that they are created because the Earth and the Moon are attracted to each other, just like magnets.

Image Credit: Joe Cashin

Our amazing Moon in our night sky above Gweedore Lake in Donegal

The Moon, of course, has been known since prehistoric times. It was called Luna by the Romans, Selene and Artemis by the Greeks, and many other names in other mythologies. Even as far back as several centuries ago it was known that the tides were caused by the Moon, the Earth's natural satellite. The Roman scholar Posidonius (c. 135 BC - 51 BC) studied the tides on the Atlantic coast at Glades in Spain. He observed that the daily tides were connected with the orbit and the monthly tides with the cycles of the Moon. He did correctly hypothesise that the tide was caused by the Moon, however, he was wrong about the cause. Posidonius thought that the Moon was a mixture of air and fire and attributed the cause of the tides to the heat of the Moon which he thought was hot enough to cause the water to swell but not hot enough to evaporate it. It was only in the seventeenth century that Sir Isaac Newton (1643-1727) put forward a mathematical explanation for the interaction between the Moon and the Earth called gravity which we still refer to today.

"A tide is the regular and predictable movement of water caused by astronomical phenomena."

Gravity plays an important role in our lives. Most importantly, it keeps our feet firmly planted on the ground, but it also plays an important job in controlling our tides. The tides are caused by the difference in the force of gravity between the side of the Earth closest to the Moon and the opposite side which is furthest away from the Moon. The Moon tries to pull at anything on the Earth to bring it closer. But the Earth is able to hold onto everything except water which flows in response to the Moon's grip. The Moon is pulling at the oceans closest to it, causing a high tide whilst on the opposite side of the Earth the pull is weaker causing the oceans to bulge away from the Moon causing another high tide. In between these two points of the high tides there are two areas of low tides. Because the Earth rotates much faster than the Moon, the bulges move around the Earth about once a day giving two high tides per day. The ocean is constantly moving from high tide to low tide, and then back to high tide again. There is about 12 hours and 25 minutes between the two high tides making the tidal cycle approximately 24 hours and 50 minutes long.

"The Moon tries to pull at anything on the Earth to bring it closer."

There are also different types of tides. When the Sun and Moon are aligned, this causes exceptionally strong gravitational forces, creating very high and very low tides which are called spring tides, though they have nothing to do with the season! They were named after the phrase "Spring Forward". This can occur when the Moon is full and new when the gravitational pull

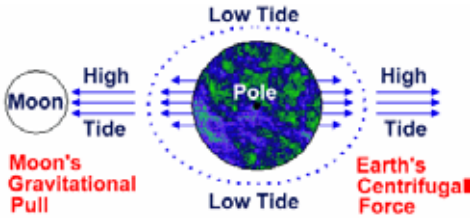

Image Credit: NASA

Illustration of the Moon's effect on Earth's tides

of the Moon and Sun are combined. When the Sun and Moon are not aligned, the gravitational forces cancel each other out, and the tides are not as dramatically high and low. These are called "Neap tides" and occur during the Moon's quarter phases when the Sun and Moon are at right angles, causing the bulges to cancel each other. The Proxigean Spring Tide is a rare and very unusual high tide. This very high tide occurs when the Moon is both very close to the Earth (at its closest perigee) and in the New Moon phase (when the Moon is between the Sun and the Earth). The proxigean spring tide occurs once every 1.5 years. Alternatively, when the Sun and Moon are as far away as they get from the Earth, which is known as apogee, tidal ranges are smaller.

Tides are most pronounced along the coastline of the oceans and in bays where tidal range (the difference in height between low tide and high tide) is increased due to the topography (i.e. surface features) and other factors such as weather conditions. A typical coastal tide range is 1.5 to 3 m (5 to 10 ft). However the Bay of Fundy between Nova Scotia and New Brunswick in Canada experiences the world's greatest tidal range of 15 m (50 ft). Northwestern Australia is also home to very high tidal range of 10m (35 ft). Large lakes also experience tides but the tidal range is often less than 5cm (2 inches). Some areas have quite amazing tidal characteristics, for instance on France's Mont St Michel Bay, between Normandy and Brittany. At the end of this bay there is the island of Mont St Michel where the tide goes out as far as 9 km, leaving the island high and dry. However the incoming tide comes in faster than a person can run! At the beach resort of Le Val André on the same bay, the lifeguards patrol the beach in boats, shouting through megaphones that the tide is coming in. It is quite a sight to see thousands of people being forced to flee. A sleeping sunbather can be half a kilometre from land in 2 m depth of water in the space of only 15 minutes!

Our tides are quite unique, if the Earth consisted of a perfect sphere covered in water to a uniform depth, the tides would be regular and boring. Because the water is contained in the oceans by the continents, our actual tides are far more interesting. The water must flow into bays and seas from the ocean and then drain out later the same day. Since this involves movement of large volumes of water which can only move at a finite speed, the tides are delayed. The further from the ocean, the later the tide will be. Although the tidal effect of the Moon on the land mass of the Earth is not much, on other planetary systems it is much more dramatic. Most notable in our Solar System is the interaction between the planet Jupiter and its moon Io. The mass of Jupiter is so large, and the tidal forces exerted by Jupiter on its moon Io are so great, that although there are no oceans on Io, the movement of the land masses is more than 5 times the ocean tides on Earth. This large movement in the land generates a lot of heat in the core, which turns molten, and tries to escape from the surface resulting in volcanic activity. This is why among all the bodies in our Solar System, Io shows the largest amount of volcanic activity.

"The knowledge of the height of tides, both low and high, is vital for many functions"

The knowledge of the height of tides, both low and high, is vital for many functions, including navigation, fishing, and the construction of coastal facilities. Surfers will also consult tide timetables to make sure they catch the best waves! They are also important for life to exist on Earth with some marine organisms exploiting the water levels to obtain food, and other animals such as birds depending on the tides to carry food in for them. The tides can also be used as a renewable energy source to produce electricity. In fact, the Bay of Fundy that I mentioned

Image Credit: Sinead McNicholl

Bloody Foreland, Co. Donegal the picturesque view of our seas

earlier, is one of thirty locations worldwide where tidal power can be harnessed to turn turbines to produce electricity. This requires tides greater than 5m (16ft). All this comes from our Moon. If the Moon was not there, we would still have tides due to the presence of the Sun, but they would not be the tides that we know today, they would be weaker. Although the tides are a beautiful thing to watch while lazing away on a peaceful day, the power and violence that they can generate is also awesome. So the next time you sit beside a pier, or stroll along the beach, you can have a think about how the Moon 386 240 km (240 000 miles) away is controlling the tides that you watch!

Red Square to Red Planet

By Martina Redpath, Education Support Officer

Future human exploration into the depths of our Solar System is currently more of a fantasy rather than a realistic aspiration. However, what about journeying to the nearer worlds of the Solar System, in particular to our neighbouring planet Mars in the not so distant future?

The European Space Agency (ESA) alongside the Russian Institute for Biomedical Problems (IBMP) is currently undertaking a study that recreates a human mission to Mars all without actually leaving Earth. President Obama has pledged that NASA will develop the capability to send people to the Red Planet by the mid 2030's, so with a mission potentially lasting a couple of years, this study aims to see how humans can cope with the physical and mental demands required on a real mission to the red planet.

This experiment, known as the Mars 500 study will run for 520 days. The timeline of this simulated mission suggests that it will take 250 days to arrive at Mars. After 30 days on Mars they will spend 240 days on their return to Earth. This experiment is being conducted in the Ground-based Experimental Complex (GEC) of the IBMP. In total the facility comprises four sealed modules which contain individual cabins, a living area, work stations, a store room and also one external module to act as the simulated Martian surface. This facility has a total area of 550m^3.

Image Credit: ESA

The Facility An interplanetary space mission is taking place right here.

Six volunteers will live and work like astronauts on the International Space Station (ISS). They are Diego Urbina from Italy, Romain Charles from France, Wang Yue from China, Sukhrob Kamolov, Alexey Sitev and Alexandr Smoleevskiy from Russia. Between them these six men have backgrounds in medicine, surgery and engineering. They are not the first to take part in isolation studies as part of the Mars 500 study. In 2007, a 14-day simulation tested the facilities, and in

2009, a crew of six spent 105 days in isolation. However, this current study is the longest and will test the physical and psychological strengths of these six.

"The Mars 500 study will last in total 520 days."

Spending a year and a half with the same five other people every day, not to see any natural daylight, and not being able to take a deep breath of fresh air, will no doubt be a challenge. However the scientists from the IBMP and ESA have plenty of work set up for the pseudo-astronauts to keep them busy. There are many scientific protocols being investigated in this study which will be crucial in planning an actual mission to our neighbouring planet. With the lack of sunlight, crew members will spend several two week periods under blue light. Lack of stimulation by visible light may cause problems with sleep therefore affecting physical and mental performance. Blood and urine samples will also be taken throughout the study to measure the levels of omega-3 in the body. This fatty acid is claimed to be helpful for general well-being and to fight off the symptoms of depression and hostility. The importance of this part of the study is to suggest a supplement that might prevent mood instability which could affect astronauts on a real life mission.

Image Credit: IBMP/Oleg Voloshin

Last minutes on Earth taken just before astronauts began their 520 day isolation study.

Living and working in space cannot be completely simulated on board this mock spacecraft: this study is less about the microgravity but more about the survival of humans in isolation for a long period of time. This study will be a major test of human endurance. The psychological changes that these men may experience play a key part in the reasoning behind this experiment. As the crew's bodies start to adapt to the different living conditions their physical fitness may start to wane, so two hours of exercise a day in the gym is a part of daily routine. Medical and non-typical emergencies, including failures of equipment and systems will be staged to see how the crew cope, thus reflecting their capabilities.

"This study is less about the microgravity but more about survival."

What is life like on board this simulated space craft? The crew are making videos and writing diary entries allowing an insight into their strange existence. After waking in the morning, the crew complete half an hour of tasks before all sitting together for breakfast. Like a real mission, all food needed for the next 520 days was packed before departure. The crew have a diet identical to the crew onboard the ISS. However, unlike a real mission water and air are pumped in and waste is filtered out rather than being stored. However, as conserving water would be an important task for a real mission so this crew must preserve their supplies by showering only once a week. A typical week will allow astronauts to work a seven day week with two days off on a rota. Throughout the working week they will also have free time to relax, watching DVD's or playing computer games. Between them they have packed a healthy supply of films, books and games to ward off boredom, with some musical

instruments packed to provide some entertainment (perhaps to play Happy Birthday), as each astronaut will celebrate one if not two birthdays on board this simulated mission.

The only contact the crew will have with the outside world is through email, and when speaking to mission control there will be a 20 minute delay in communications in order to seem as realistic as possible. Due to the delay in communications, this crew have been trained to fix every bolt of their spacecraft and to be as self-reliant as possible as relying on mission control will not be an option if an emergency were to arise.

Research onboard the International Space Station is essential for measuring the effects of microgravity, radiation and other space-specific factors. However, overall this Mars 500 mission will look at the aspects of long-term isolation and confinement which is easier researched through ground based simulations. As the crew are currently on their transfer flight to Mars, due for arrival January 2011, and with still more than a year left in confinement, we are left wondering how these earthbound astronauts will cope and adapt to their new life in interplanetary space.

Image Credit: IBMP/Oleg Volotshin

Orlan Spacesuit: The space suit to be worn during the 30 day simulated surface operations

September Night Sky

By Mary Bulman, Education Support Officer

I hope September will bring clearer nights for stargazers than we have been having so far this summer. The sky is also beginning to get dark a little earlier making it easier to pick out some of the fainter patterns without staying up all night.

The September equinox occurs on 23 September. This marks the first day of autumn (or fall) in the northern hemisphere and the start of spring in the southern hemisphere. You can find the exact positions of east and west where you live on this day. At sunrise the sun will appear above the horizon directly east and will disappear at sunset straight west. Following this date, you can watch the sun quickly set farther southwest on the horizon each night.

The full moon closest to the autumnal equinox is usually called the Harvest Moon because it rises near sunset and prolongs the daylight allowing the reapers to gather in the harvest. The Harvest Moon often appears larger than other moons when seen rising close to the horizon. This is an optical illusion. It appears to shrink as it rises higher in the sky. This year there is a full Moon on 23 September thus equinox and harvest Moon coincide.

The wandering stars (as the Ancients called them) of Venus, Mars and Saturn will leave our evening sky this month. They can still be seen early in the month low in the south western horizon, but with difficulty. Planet watchers should concentrate on Jupiter. With a telescope or a good pair of binoculars you may even see

the Galilean moons. Uranus is also visible using a telescope from around the third week of the month and can be found close to Jupiter. For the early risers or the party people returning home after a night on the town see Mercury put on its best morning sky show of the year from the second week of September. The innermost planet stands almost 10° above the eastern horizon at the beginning of morning twilight from the third week of September.

Image Credit: NASA/JPL-Caltech/UCLA

The next door neighbour: The immense Andromeda Galaxy, also known as Messier 31 or simply M31, is captured in full in this image from NASA's Wide-field Infrared Survey Explorer, or WISE.

While the Summer Triangle is still visible in the sky after sunset, the autumn constellations are now appearing in the southern sky, the most notable being Pegasus, the winged horse of Greek mythology. To find Pegasus face south-east and look for four stars of about the same brightness that form an almost perfect square. This pattern forms the body of the horse and is the well known Great Square of Pegasus. Start at the lower right corner of the Great Square and continue your gaze to the right (westward) and down along Pegasus' neck and then slightly upward to a brighter star.

This bright star represents Pegasus' nose. It is called Enif and is the 18th brightest star in the sky. You will of course notice that Pegasus is actually upside down in the sky.

The Great Square of Pegasus is very distinctive and is a useful signpost in the sky at this time of year. So I am going to tell you how to use it to locate other patterns and stars in the heavens. All that's needed is a clear sky, our star guide which is enclosed, and a mathematical frame of mind. Creating an imaginary line beginning with the top right star of the Square, go through the top left star, extend it twice the distance between these stars and you arrive at a point that is between the constellations of Aries, the Ram, to the south, and Triangulum to the north. Aries is a very old constellation passed down by Ptolemy as one of the 48 recorded in his Almagest. Although it is small, Trianglum was known to the ancient stargazers and was also listed by Ptolemy. It is home to a beautiful deep space object, the Pinwheel Galaxy.

Just above Triangulum is the constellation of Andromeda, the princess. This princess has the belly button of a horse as her head since she shares the star of the upper left corner of the Great Square with Pegasus. The remainder of Andromeda can be traced out in the sky as a great A shape. Taking the top left star of the Great Square and imagine drawing a diagonal through the bottom right star and extending it the same distance outside the square you will arrive at a bright star, Sadal Melik. To the east of this star is the modern day asterism known as The Steering Wheel.

"One last celestial gem that can be located using the Great Square is the Andromeda Galaxy. "

Taking the other diagonal and starting at the top right star, through the bottom left, and continue down the sky south east for twice the distance of the diagonal and you will come to a star that marks a stellar heart. This star marks the heart of Cetus, the Whale. In ancient Greek legends Cetus was a sea monster and as befits a monster it is the fourth largest constellation in the heavens. Apart from one bright variable star Mira, the stars of Cetus are rather faint and it is low in the horizon this month. Keep an eye on it over the next few months.

In line with the western side of the Square of Pegasus, just above the horizon there is a very bright star. It is called Fomalhaut and is the mouth of the southern fish, Piscis Austrinus. Sometimes known as the Lonely Star of Autumn, it is easy to locate but you do need an unobstructed, dark horizon. Fomalhaut may not be as lonely as we thought as the Nasa/ESA Hubble Space Telescope has discovered a planet orbiting this star. It has been creatively named Fomalhaut b.

Image Credit: ESA, NASA and L. Calçada (ESO)

Is there life out there? This illustration shows the newly discovered planet, Fomalhaut b, orbiting its sun, Fomalhaut. Alas this world is as cold as Neptune and life there is unlikely.

One last celestial gem that can be located using the Great Square is the Andromeda Galaxy. This is the closest large spiral galaxy to our home Galaxy, the Milky Way, and is located 2.5 million light-years from our sun. To spot the galaxy, start at the top right star of the Square and draw an imaginary line to the top left corner of the Square. Now take your gaze roughly the same distance to the north east to a star of about the same brightness. Just higher in the sky you will see two faint stars and beside the second star is located the Andromeda Galaxy which is one of the most distant objects visible to the unaided eye. It is best viewed through a telescope. It may not be such a spectacular sight but you are looking back in time 2.5 million years and I find that quite amazing.

I hope you enjoy your stargazing this month and at the same time improve your maths by brushing up on your diagonals and distances.

Moon Phases, Sept 2010

Wed 1st Sept	Last Quarter
Wed 8th Sept	NEW MOON
Wed 15th Sept	First Quarter
Thur 23rd Sept	FULL MOON

Still Impossible!

By Colin Johnston, Science Communicator

For the past couple of issues I have been showing to my satisfaction that faster than light travel (FTL) is impossible. Just to clarify, all these arguments apply not just to people flying through space in starships but also any superluminal communication of information. In science fiction a FTL “radio” is usually called an “ansible” (a word coined by the awesome Ursula K. LeGuin: note that ansible definitely, absolutely is not an anagram of anything), but ansibles will never be built. By the end of this piece I hope to show that FTL chatter is as unfeasible as FTL travel. But first, I have to demolish the best known FTL mechanism of them all.

A couple of months ago I mentioned that Einstein (the scientist, not the parrot) had two theories of relativity. The original one, ‘special relativity’, published in 1905, points out the practical difficulties of travelling at the speed of light. Every blockbuster demands a sequel, so Einstein unleashed “general relativity” in 1915. Introducing his theory in a presentation to the Prussian Academy of Sciences, he revealed that space and time were one and could be warped by gravity. No doubt this bombshell was met by stunned silence (apart from the plink-plink sound of falling monocles).

Less than five years later observations of starlight deflected by the Sun’s gravity by Arthur Eddington proved to most sensible people’s satisfaction that Einstein was right. Today few doubt that general relativity describes the

Universe accurately. (You will see websites where Einstein and his work are stridently and vigorously decried; many of them seem to me to have an unsavoury agenda unrelated to science. They leave me with the distinct impression that his theories would be more acceptable if Einstein had been, say, a blond German called Aryan Von Übermann.)

By the 1960s the warping of space was a widely accepted but little understood concept. So widely known was it that it even made it to Hollywood. There it was taken on board by an ex-combat pilot, ex-LAPD cop turned screenwriter who had this little idea for a series about characters on a great journey, a trek if you will, through space. Gene Roddenberry (for it was he) needed a plausible-sounding piece of technobabble to justify the USS Enterprise's speed of plot and the solution was 'Time Warp Drive' (the 'time' bit was soon dropped). Now where was I?

Oh, yes, FTL, in the many iterations of Star Trek, starships whoosh faster than light across the galaxy by the efforts of warp drive, but how is this meant to work? Warp drive bends space around the ship, enclosing it in a bubble of curved space. This bubble can move at speeds greater than light because Einstein's speed limit does not apply to space itself. Meanwhile the ship is carried along inside the bubble. Neat, eh? But does this science fiction nonsense have any relationship to real science?

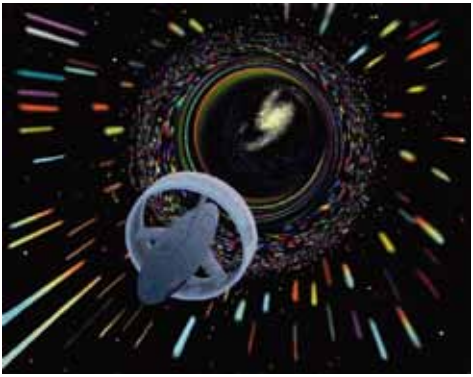

Image Credit: Les Bossinas, NASA

Not going to happen: A NASA artist's impression of an FTL vessel in flight through a wormhole.

In 1994 a physicist called Miguel Alcubierre published a paper containing a sort of mathematical justification for this (although it never mentioned Star Trek). He described how the ship would draw itself forward by contracting spacetime ahead of it while expanding it ahead in an effect analogous to one of those moving walkways they have at airports. This was announced as proving that warp drive could exist. It was met by the ecstatic rejoicing of Trekkies everywhere.

"FTL is functionally equivalent to time travel"

Allow me to add a bucket of cold water. For this to work, there must be a ring of intense negative energy wrapped around the ship. Negative energy, like tachyons, hyperspace or Spiderman, is an impossible thing that does not exist. Note too, this whole idea assumes that the whole "warp bubble" would indeed move faster than the speed of light. We simply do not know that. Dr Alcubierre is a very, very clever man, but his concept is simply a theorist's plaything, stretching Einsteinian physics to breaking point and seeing what happens. Ignore any TV science communicator who claims that we could use this theory to propel a starship anytime soon (you know who I mean; I note too he's saying that 5% of reported UFOs may be alien spaceships, it seems that appearing on TV leads science communicators to madness).

"A central tenet of science is the concept of causality"

This should be the end of our journey investigating the implausibility of FTL and feel free to move on to the next article. If you want to stay I will try to explain the deeper reason why FTL will never happen. This will be what that great SF author, the late Bob Shaw called a "wee thinky bit" so you're not exactly in the safest of hands.

A central tenet of modern science is the concept of "causality", the idea that cause precedes effect. I spill a cup of hot coffee on to my lap and I yell out, the yell (effect) comes after the

spill (cause), everyone who observes this minor disaster agrees on the sequence. So far so simple. However this is vital: causality is the philosophical glue which holds science and technology together. Imagine a machine, made of three subcomponents, A, B and C, which act in sequence to do a task at the press of a button. So I press the button, starting component A, A does its stuff, starts off B …all the way through to C and the desired outcome. How could such a thing be designed in a world without causality where C sometimes is activated before A, which happens before the button is pressed? If anything can move faster than the speed of light causality collapses and so does the whole, carefully-assembled edifice of science. Let me try to illustrate this.

I'm sitting on an armchair in my living room. Outside in the garden some kids are playing football and I'm watching their game through the window. One child kicks the ball a little too enthusiastically, and it heads straight for me. I see it getting closer, then smashing through the window to sail across the room before it strikes me, gently, on the nose. As I see it, the sequence of events goes: ball kicked, flew through garden towards me, broke window, flew through room towards me, hit nose. Meanwhile the child sees it as: ball kicked, flies through garden towards old geezer, breaks window, flies through room towards geezer, hits geezer's nose.

"Starlight deflected by the Sun's gravity proved that Einstein was right"

Now let's repeat the drama, the events are exactly the same except this time the child kicks the ball so hard it travels at a speed faster than light (the little blighter has had his Weetabix this morning). The ball is kicked, gets closer to me, then smashes through the window and hurtles across the room. The child agrees with this as he sees the events as: ball kicked, flies through garden towards house, breaks window, flies through room towards victim, hits his nose. But, unfortunately, before I see the sequence of events, the ball has overtaken the light carrying this information and already hit me! In fact as I see it, the sequence of events goes: Hit on nose by ball, window breaks, child kicks ball. As far as I am concerned the events happen in reverse order! Causality has been overturned!

"The Universe just doesn't allow it"

What is more, if FTL communications are possible, then it would be possible to observe a distant event occurring and transmit this information back the site where it occurred before the event happened. So I could conceivably be hit by the FTL football and with my super-fast reflexes immediately scribble the words "DO NOT KICK THE BALL" on it and kick it back to the footballer at FTL speed. It hits him just before he kicks it. What happens if he reads my words

Image Credit: ESO

HD 10180 Any journey to see this wonderful multi-planet system will take at least 127 years

and doesn't then kick it? It doesn't hit me, so I don't tell him not to kick it, so he doesn't and ...well, you get the idea (note too how there are two balls at one point in the narrative).

Paradoxes like this are common in both great works of science fiction and TV's 'Dr Who' (I am so going to get hate mail for that), but are impossible to fit into a logical and consistent universe. FTL is functionally equivalent to time travel into the past, opening a horrendous can of worms (a fact little acknowledged in SF, only Steven Baxter and Charles Stross seem to have made use of this). This is the deeper reason why FTL travel is impossible. Alas, we will never fly to Wolf 359 and back in 45 minutes or gossip on the phone with ETs on Eta Andromedae in real time.
The Universe just doesnt allow it.
Please prove me wrong!

Image of the Month

Image Credit: Thomas Needham

Here in Northern Ireland we are often challenged when it comes to observing the stars planets and other astronomical phenomena. The chances of having a cloudless sky for observing are, on average, 1 in 4.

So despite the yearly regularity and visible abundance during peaks nights, perseverance is sometimes necessary in order to see the Perseid meteor shower.

In the case of Thomas Needham from Carrickfergus, this perseverance finally paid off on 15 August 2010, three days after the peak event.

Thomas was finally able to photograph one of these small pieces of debris, left behind in space by the comet Swift-Tuttle, as it burned up in our atmosphere.

(Caption by Tracy McConnell, Education Support Officer)

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