The MASS³ Monthly

MONASH ADVANCED SCIENCE & SCIENCE SCHOLAR SOCIETY NEWS

IMAGE COURTESY OF LIGO

Making Waves in Science

Spacetime, gravitational waves, and how LIGO proved Einstein right— while bringing a new way to see our universe. (Read it on Page 2)

Plus: We speak with Dr. Eric Thrane, lecturer at Monash University and a member of the LIGO team (Interview on Page 4)

In This Issue

MASS³ Community News

A WELCOME FROM OUR DEAREST OVERLORD

Hello one and all, and welcome to this, the first newsletter of 2016!

I hope you all had a great break and good sleep, because don't worry - we're starting off strong!! Literally writing this just after I attended the 2016 Research *JAFFY* camp, and also haven spoken to some of the incoming GCers, I can promise you - we have a nice batch of fresh blood coming in (if just a tad *memey*).

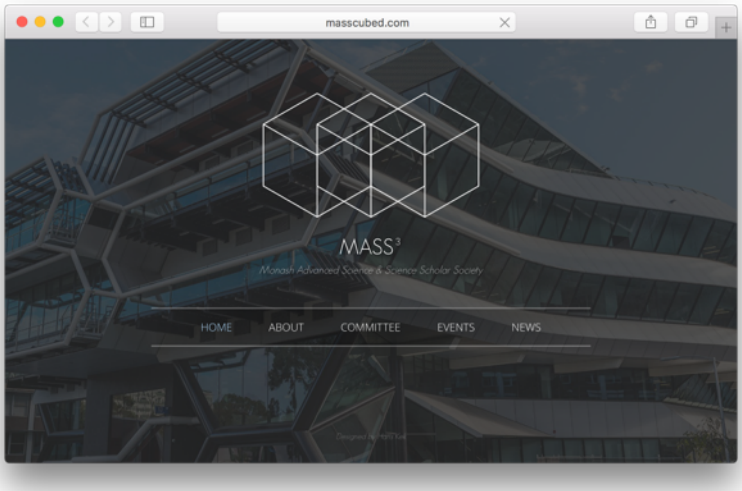
I won't keep you on this page too long, the rest of the newsletter is where the real gold is, but I do want to put in this little bit: for this year, the club is taking a focus to our more academic side. We will still run just as much social stuff as we did last year, so don't stress about losing our precious trivia or karaoke! Even more than that, don't be scared we will become too academic - we will still make sure to have all the pizza you can possibly imagine! However, if you have an idea for something academic that you want to see, just let a committee member know!

Finally, keep an ear out on your e-mails and/or Facebook, because our annual OGM will be coming up soon. In particular, we'll be looking to vote in a new first year GC and research rep into the committee. If you're in first year, this could be your chance to get involved!

Have fun, stay safe, and *please don't die*!

— Keith Beards, MASS³ President

Other MASS³ Updates

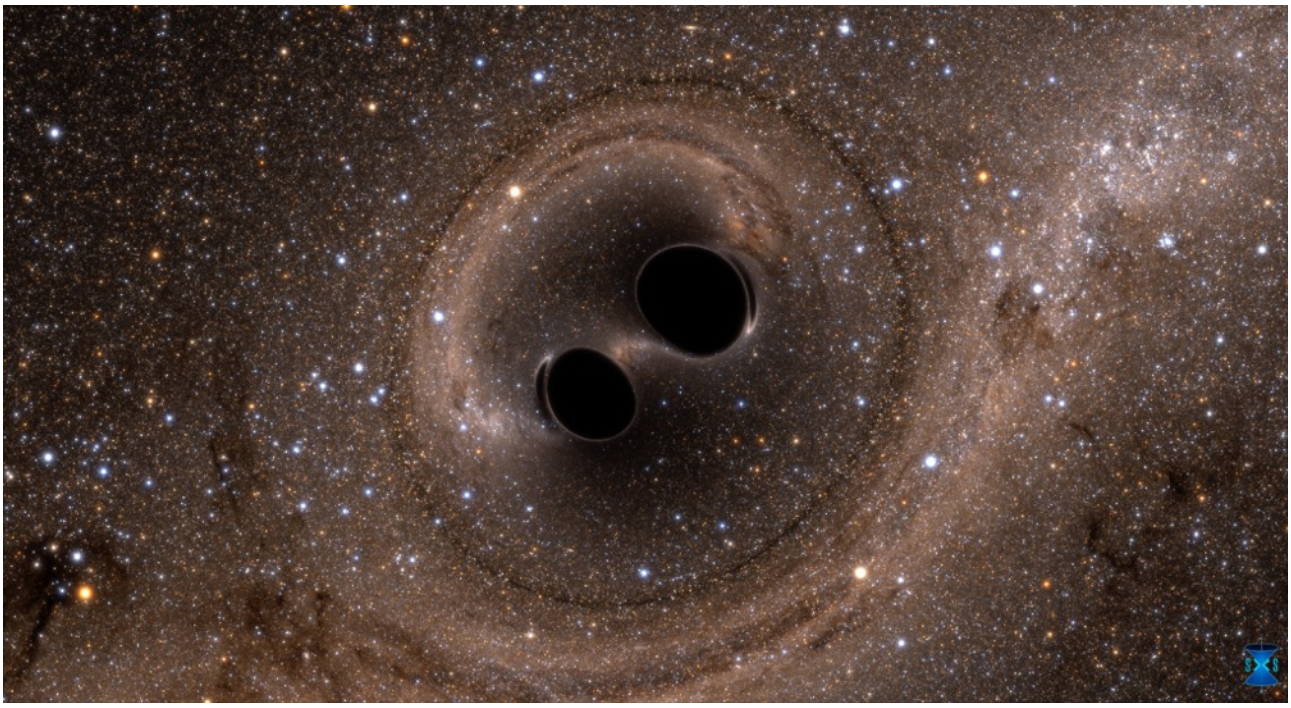


A new masscubed.com!

Check it out! MASS³ has an entirely new website, designed (handcrafted, he'd say) by our very own webmaster, *Hans Kek*. It's the best place to go if you need to contact us. (Also: search for the Easter eggs!)

Making Waves in Science

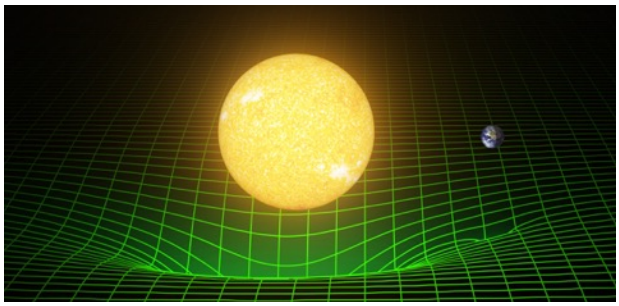
SCIENCE NEWS REPORT BY CARLOS MELEGRITO



IMAGES COURTESY OF LIGO

A LONG TIME AGO, IN A GALAXY FAR, FAR AWAY, about 1.3 billion light years away from Earth, two black holes 30 times the size of our sun, orbit one another. As they spiral around, each of their own gravity pulls them together, closer and closer— while spinning faster and faster. Eventually, they collide, implode and merge into one singular black hole.

When supermassive objects like these spiral around and accelerate in space, their gravitational fields interact, causing ripples in the fabric of spacetime. These waves travel outward at the speed of light, stretching and squeezing the relative distance between objects. This is how gravitational waves form— at least, that's what Einstein predicted back in 1915. And today, it is now *confirmed* thanks to LIGO.



But what exactly are ***gravitational waves***? (*If you're a physics major, feel free to jump to the puzzles section if you're looking for more of a mental challenge*). A little about gravity: as it turns out, gravity isn't an all-encompassing magical force that surrounds us, penetrates us, and binds the galaxy together— it's more interesting than that. Let’s try to visualise it.

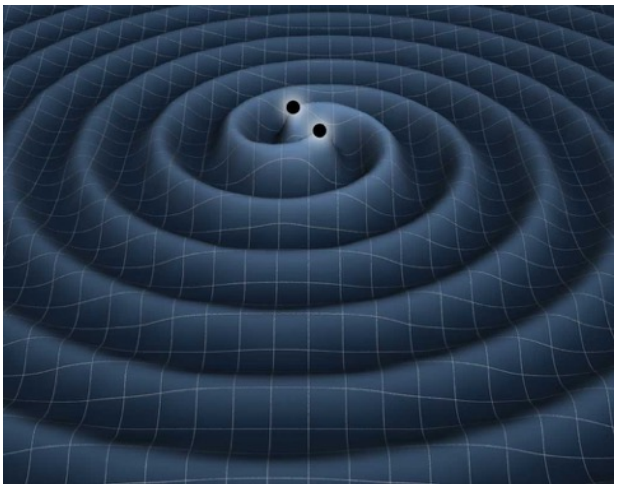


IMAGE COURTESY OF NASA

Visualising Spacetime & Gravity

- *Compress 4 dimensions into 3 by imagining spacetime as the surface of your (very soft) bed. If you've got some marbles handy, roll them across the blanket. Notice how the balls travel smoothly in a line.*

- *Next, sink a bowling ball on top. You'll see that the bowling ball creates a well underneath it and around it. Now try and roll one of the marbles in a straight line just next to it. What should happen is that the marbles follow the curvature of the well around the bowling ball.*

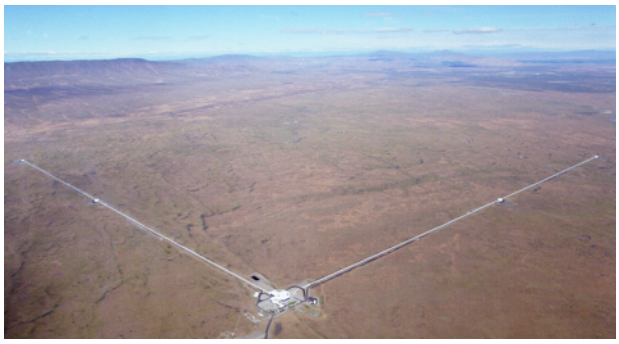
Gravity works the same way. Massive objects curve the 'surface' of spacetime, affecting the behaviour of objects that pass near them. In our case, the sun is the bowling ball, and the marbles would be the planets (*NOT* to scale).

Gravity makes it look like dense masses attract each other— but really, they're just following the curvature of spacetime.

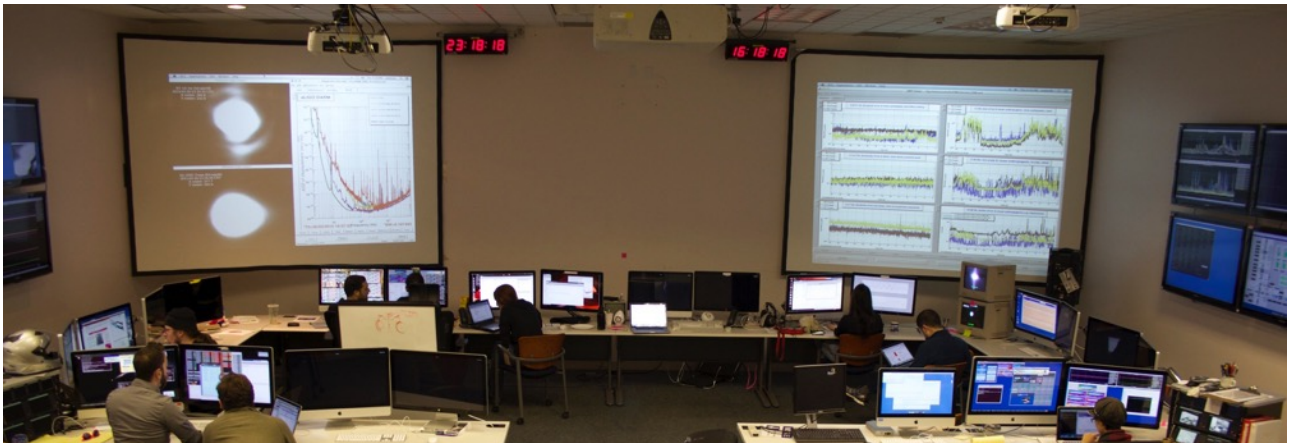
Instead of the surface of your bed, imagine spacetime as the surface of a swimming pool. As massive objects move, this creates ripples on the surface. In 4 dimensions, and in spacetime, these are the gravitational waves that ripple through.

So how does LIGO even detect these gravitational waves?

LIGO stands for *Laser Interferometer Gravitational wave Observatory*, and the L-shaped building that you can see is precisely that. An interferometer is basically a laser beam, split into two, fired perpendicular from each other towards mirrors at either end. These laser beams are then reflected back towards a detector, and measures the time difference between both beams.



Common sense says that splitting a laser beam into two and firing them back in the same distance should really have no time difference. But the theory is, as spacetime distorts, the distances between the two mirrors should change, thus giving a delay between both beams. Furthermore, Einstein's Theory of Relativity states that the speed of light is constant everywhere, independent of this distance change.



And so, results they have detected: the gravitational waves emitted by the black holes caused the mirrors on either end to move— by about *1/10,000* the size of a proton. Indeed, a tiny change, but it's enough to crash waves around the astrophysics community and beyond.

Why are these results so groundbreaking? Because, not only have they confirmed the last of Einstein's Theory of Relativity (and Gravitation!), but it provides a whole new way of studying the universe. It's as if Galileo decided to point a telescope to the moon for the first time all over again.

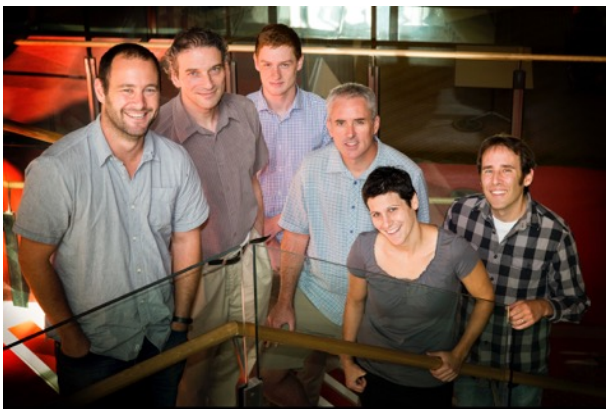
It's an introduction of new ways to use equipment like never before— and it's one step closer to finding out why the universe is the way it is.

Dr. Eric Thrane & LIGO

IMAGES COURTESY OF MONASH UNIVERSITY

MASS³: *What was it about gravitational waves or Einstein's theory that sparked your curiosity that eventually led you into researching it at LIGO?*

Dr. Thrane: I think there are two things that appealed most to me about gravitational waves and LIGO. First, I liked the idea of helping to create a whole new way of looking at the sky. For hundreds of years, the only way of doing astronomy was with visible light. When astronomers developed the ability to study different wavelengths, (e.g., infrared or X-ray), great discoveries followed. If history is a guide, gravitational-wave astronomy may yield great insight into the cosmos. Second, LIGO is a marvel of engineering. It pushes technology to the limit in order to measure unimaginably small distortions in the fabric of spacetime. I liked the idea of working with such an amazing instrument.



Dr. Eric Thrane is one of the many members of LIGO's team that detected gravitational wave transient GW150914— and therefore helped shape the future of astronomy.

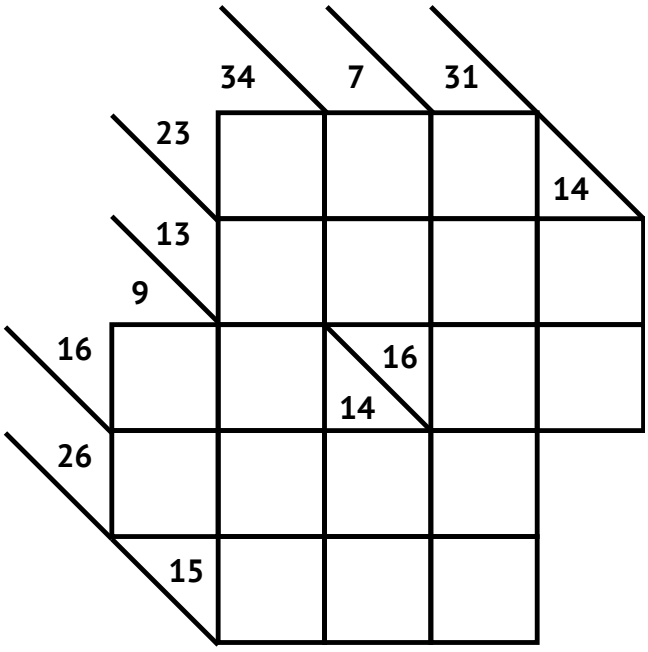
MASS^3: ***Indeed, LIGO's such an incredible instrument. An interferometer! Back in Einstein's time, no-one would've thought that it could've been used for looking at space!***

So what's next? What are your plans at LIGO from here on in?

Dr. Thrane: The confirmation of Einstein's theory of general relativity is just the beginning for LIGO. Now that we've seen one pair of black holes smash into each other, we know there are more out there, waiting for us to discover. Each signal will tell us something new about the universe. We hope to detect other sources of gravitational waves as well, for example, ultra-dense objects called neutron stars. And who knows...we may see something totally surprising!

Dr. Eric Thrane is a lecturer at Monash University in the School of Physics and Astronomy. Find out more about him at http://users.monash.edu.au/~erict/

Kakuro Puzzle (Level: Easy)



How to Play:

- The objective of the game is to fill the grid on the left with numbers.
- Every box can only contain any of the integers between 1 through 9.
- The numbers outside the boxes are mathematical clues, corresponding to the sum of the numbers in the row or column.
- Think of the game as a crossword, but for numbers (in fact, the name *Kakuro* comes from a Japanese transliteration of the word!)
- For more information, go to **kakuro.com/howtoplay.php**

A Guide to Delivering Awesome Science Presentations

TIPS AND TRICKS BY CARLOS MELEGRITO

IMAGES COURTESY OF GETTY IMAGES

Full disclosure: I'm no expert in this field. I tremble at the fear of doing public speeches— and if I were forced to volunteer at a stand-up comedy show, the humour would come from my petrified self. (So to speak). Hence, the information provided here comes from everything I've been taught last year— enjoy!

Aim:

To understand the techniques behind delivering an interesting and informative oral presentation.

Hypothesis:

Following the advice, tips and tricks on this article will result in a more successful presentation, and a 110% increase in effectiveness.

Materials Required:

Your voice, something interesting to talk about (perhaps your thesis on anti-neutrinos), emergency underpants and the latest version of Microsoft PowerPoint (optional).

MSDS / Safety Information:

Public speaking can be daunting, but with enough practice, it can become easier!

Method:

1. **UNDERSTAND YOUR AUDIENCE**— Before preparing your presentation, ask yourself the following question: *who will I be talking to?* Although seemingly trivial, it helps to know a lot about what kind of audience you're delivering your message to. Will you be presenting to primary school kids— or will you be presenting to some potential job hunters or even granters of your next scholarship? (Bonus: try to understand why they came to your presentation in the first place).

2. **REFINE YOUR MESSAGE**— It always helps to understand what you want to say. Presentations shouldn't take longer than one screening of *The Lord of The Rings: Return of The King*— and great presentations are short and concise. In other words, there's a time limit, and there's only so much you can talk about. The best thing to do is to try and fit the key ideas you'd like to talk about on a single index card. Or— list all the things you'd like to include, and cross out the least important ones until you've only got a handful of points left.

IMAGE COURTESY OF NEW LINE CINEMA

Even Gandalf knows that the Balrog is no match for just one memorable line.

3. **TELL A STORY**— When Steve Jobs was in the middle of presenting a keynote, the remote used to control his slides malfunctioned. So, while waiting for the backstage crew to fix the issue, he leans forward, and tells the crowd an intimate story from his childhood. When used correctly, stories are one of the most effective ways to grab your audience's attention. So, tell a story that relates to your key message! For example, if you're talking about viruses, talk about how it has affected people. Or in another case, if you're talking about the solar system, talk about how Galileo helped popularise the Copernicus view of the planets revolving around the sun!

IMAGE COURTESY OF HUFFINGTON POST

That one time Steve hacked together a TV Jammer to annoy his friends.

4. **KEEP YOUR SLIDES SIMPLE**— Unless you tell your audience to stare at one slide for ten minutes, **nobody's** going to read a wall of text on your PowerPoint. If you want your audience to come out remembering what you've told them, make your visuals as minimal as possible. Most of the information will enter your audience's ears, and their eyes are reserved only for the most impactful of images. Think like a movie director: when you hear the start of the Jurassic Park theme music, you should cue a mighty image of a T-Rex— and nothing else! (Hence, it's more frightening that way!)

IMAGE COURTESY OF UNIVERSAL PICTURES

It's all about focus— having too many flares could confuse the T-Rex, cause a rampage and kill everybody.

5. **FIND A DELIVERY STYLE**— In other words, be yourself. Unless you're an Oscar-nominated actor, it's difficult to pretend to act like someone you're not. If you're cool, calm and collected, talk slowly, clearly, and pace your presentations much slower. If you're extroverted and excited, mirror your enthusiasm throughout your talk. But, be careful! It's also important to fluctuate tones depending on the subject matter. You can't speak enthusiastically about potentially catastrophic seismic activity (unless you're Martin) or weep at a scientific breakthrough. The way you speak must reflect who you are, and what you talk about!

Results:

(Data unavailable. Instead, please refer to your favourite TED talk, lecturer or even an awesome video you've seen on the internets. May I recommend "Why I Fell In Love With Monster Prime Numbers" by Adam Spencer. Yes, Google It!)

Conclusion:
These five key notes are the fundamental backbone to an engaging presentation. Try and apply them the next time you're asked to give a speech or present a lecture. With enough time and practice, you may potentially be asked by the folks at TED to give a talk about your paper on space dust!

Good luck on your next presentation!

Monash CLV (Careers & Volunteering)

A WORD FOR OUR SPONSOR

Here's the situation: you're nearly finished with your degree, and you're feeling that tiny bit of stress from looking for a great job that best suits your major.

The solution? Well, it's *Monash University*'s own careers and volunteering service! From mock job interviews to fully-fledged presentations on cover-letter writing and employability skills (a must!), everything you need to get the job you want is right at your footsteps. Visit the brand-new office at Clayton Campus Centre, or head over at monash.edu.au/careers.

Upcoming Monash CLV Events

- ***First Year Students: Tips to Boost your Employability Skills***, February 23, 24 & 25 @ 3:00pm-3:30pm, Clayton Campus, 46 Exhibition Walk (Rotunda), Lecture Theatre R1 — https://careergateway.monash.edu.au/students/events/detail/2840753/first-year-students-tips-to-bo

- ***Employment Essentials (Clayton)***, February 25 @ 10:00am, Clayton Campus, 21 College Walk (Building 32), Lecture Theatre E1 — *https://careergateway.monash.edu.au/students/events/detail/2838931/employment-essentials-clayton*

For more information, visit https://www.monash.edu.au/students/career-connect/seminars-events.html?source=careers-connect-home.

Worded Problems (Level: Medium)

- Order all nine digits such that the first two are a multiple of 2, the first three are a multiple of 3, and so on— until all nine digits form a multiple of 9.

- Slice a pizza such that half the slices don't touch the centre— all while keeping every slice of the same area and size.

- On a piece of paper, trace over an Australian 5-cent coin. Cut this circle out. Now, how do you get an Australian 2-dollar coin through the hole without tearing the paper?

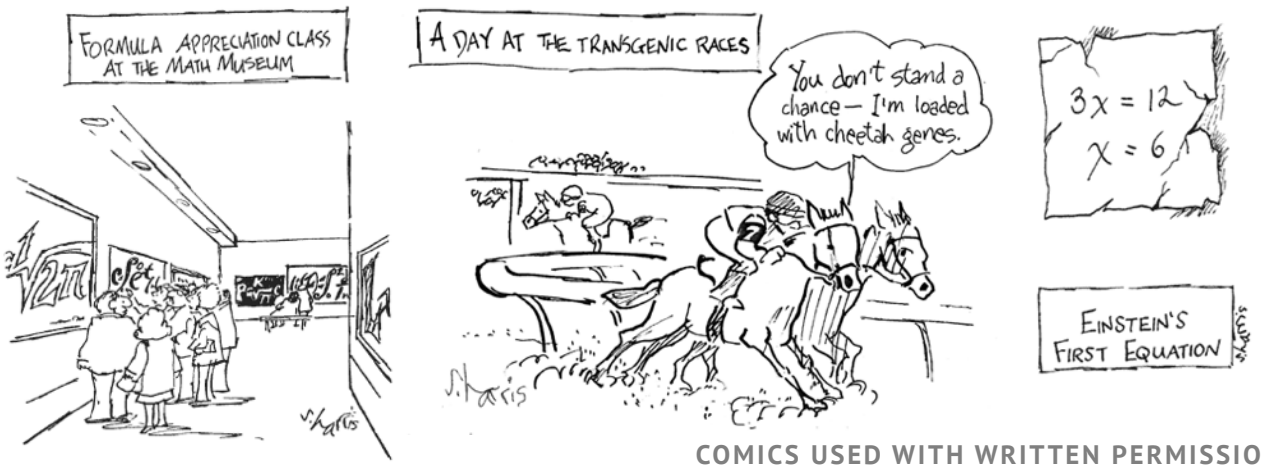
- If Delilah can write an essay in 3 hours, and Henry can write the same essay in 5 hours, how long would it take for them to write the same essay together?

- A sealed sink full of water has a toy boat, with an anchor attached, floating on top. The anchor is then removed from the toy boat and placed into the water. Does the water level increase or decrease?

Upcoming Events in MASS^3

Orientation Day BBQ

- **When:** Monday, February 22 from 12:30pm onwards
- **Where:** Next to the Science Student Learning Lounge
- **Why:** This is for the first years! Meet and greet 'em! Show off your enthusiasm for science, uni, and the great campus that is Clayton! Feel free to introduce yourself, your friends, fellow cohorts, answer any questions that may be thrown at you, all the while making the next generation of first-years feel all the more welcome!



COMICS USED WITH WRITTEN PERMISSION

Write for The Newsletter!

THE MASS³ MONTHLY WANTS YOU!

IMAGE COURTESY OF MARVEL

Got something cool to say? Feel the need to get your voice heard? Wanna promote something? Well, look no further! The answer is right in front of you!

This is the second issue of the newsletter's latest version, and although it's already filled to the brim with community reports, science news, comics, jokes and puzzles— there's still enough room in every issue for more!

So if you've got some ideas or you're willing to drop in as a guest writer, feel free to email me at cjmel2@student.monash.edu.

Next month's issue will bring back the *interviews* with lecturers and students alike, plus— reviews for units and other events. And depending on community feedback, the following sections may (or may not) be added in:

- Advice Column
- Science Film Review
- Book of the Month Review
- Fiction Column
- Overheard at the Common Room
- Research Advanced Student Projects
- Global Challenges Updates

Truth be told, there's only one person behind the newsletter— so it'd be great to get more hands towards contributing!

The Answers At The Back

FOR ISSUE I, OCTOBER 2015

9	**4**	1	**7**	**6**	8	**3**	**2**	**5**
8	2	**5**	**4**	3	**9**	7	**6**	**1**
3	**6**	**7**	5	**1**	**2**	**9**	**4**	8
4	**5**	6	8	**9**	1	2	**3**	**7**
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5	**8**	4	**9**	2	**7**	**6**	1	**3**
6	**9**	**3**	1	**5**	**4**	8	**7**	**2**

Crossword: Biology Crash Course

Across:

1. Mitochondria
5. TAQ
6. Malaria
7. Liver
9. Chromatid

Down:

2. Translation
3. Haploid
4. Ribosome
8. Telomere

Perfect Square of Threes:
See https://projecteuler.net/problem=142 for a detailed explanation.

A Waiter's Dilemma:
Again, this one's too long to explain. It's basically the '*knapsack problem*', and there are many ways to solve it. (Google it!)

Questions? Feedback? Comments? Suggestions?

Got a question for the editor, or something you'd like to say about the newsletter? Email cjmel2@student.monash.edu.

Looking to say something to the MASS³ Committee? Contact mass3@monashclubs.org!

Note that while the newsletter strives to present information as accurate and valid at the time of publication as much as possible, there will always be a mistake somewhere. If you spot any, promptly email the editor.