THE ESSENTIAL SINGULARITY

Recap of Events

Kyna Schrick and
Nathan 'Greg' Jones

On the 7th of August, all the Science kiddies across Curtin united for a night of intense board game action. Board Games Night was the first Curtin Science Alliance (CSA) event in the history of the known universe! The Science Alliance is a cooperative association between Curtin's science clubs to help offer a wider range of events for each club's members and help bring down the archaic walls between the disciplines. The Board Games Night had a great turnout, and much fun was had through high-stakes Catan and UNO games. We would like to thank all club representatives that organised the event, the very lovely Curtin Tav Staff, and everyone who came along!

Rumour has it that there are two more CSA events in the pipeline so keep an eye on your existential rectangle devices or the next month's issue for more info!

We also joined with the Curtin Film Society on the 13th of August to watch the movie Oppenheimer! Thanks to everyone who came along and participated in the discussion, it was interesting to hear all your perspectives. Particular thanks are due to Clancy for the idea and for supporting the event.

Finally, we held our very first research showcase on the 19th of August! We had representatives from atomic collision physics, HSRG, carbon physics, CIRA, planetary physics, computational chemistry, and applied maths set up tables and talk about their work in an expo-style format. It was a great evening with interesting discussion and lots of opportunities, and a huge thank you to all the academics for volunteering their time!

Top: The CSA Board Games Night.
Mid: The Oppenheimer screening with the Curtin Film Society.
Bottom: Students and academics at the research showcase.

Editorial
Jamie Erak

For this month's editorial, I would like to do something highly unusual: be serious. Many readers will likely know that this August was the 80th anniversary of the atomic bombings of Hiroshima and Nagasaki.

The ethics surrounding these attacks, and nuclear weapons in general, are fiercely debated to this day. These debates are best left to other forums (such as the Oppenheimer screening night!), but I would like to comment on a humbling lesson they teach us.

Confronted with the fragility of our world, it is easy to feel helpless. There are times when it seems easiest to focus on science and retreat to what we know. We must remember, however, that the work of physicists has shaped the course of history, both directly and indirectly. As physicists (or aspiring physicists), it is our duty to advocate for the responsible use of this power, i.e., to use it to build a future where all can live safely and happily, and where kindness and understanding triumph. In this, we must never cease, especially when it seems impossible.

The paper crane has become a well-recognised symbol of peace. This particular example (my best attempt) is also a symbol of my general incompetence.

August: A month of crane-spotting
Karissa Clarke-Liddell

AdS/CFT: Studying condensed matter via black holes?!
Jamie Erak

I have once again been gifted some extra space, which I will take advantage of by discussing something interesting I've learned about recently: The anti-de Sitter /conformal field theory correspondence (henceforth referred to as AdS/CFT).

For those who are frightened, don't worry! I won't go into the details (nor, indeed, do I know enough details). Essentially, AdS/CFT relates a gravitational theory in a d+1-dimensional spacetime called anti-de Sitter space with a conformal field theory (a type of quantum field theory, or QFT) on the d-dimensional boundary. One particularly famous example is between type IIB string theory in 5D and supersymmetric Yang-Mills theory in 4D.

In addition to being an extremely useful tool for studying theories of quantum gravity, AdS/CFT also provides an unexpected way for such theories to be connected to the real universe. Strongly interacting QFTs, which are common in condensed matter physics, are often unsolvable using standard perturbative approaches. Using AdS/CFT, however, they can be mapped to more tractable gravitational problems. For instance, results from black hole hydrodynamics have been used to place a lower bound on the ratio of shear viscosity to entropy density for a wide class of strongly-interacting systems (see Kovtun et al., 2005).

Such results remind me that even seemingly different areas of physics can be interconnected in fascinating and unforeseen ways. The 'horse of true mathematics' may traverse any field!
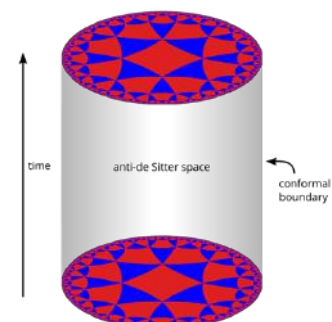
A visualisation of a CFT on the boundary of an AdS spacetime. Source: Wikipedia (n.d.).

Upcoming events

Curtin Under the Stars
Date: Friday August 29
Time: From 19:00
Venue: Lawn outside 215
We are partnering with the WA branch of the Australian Institute of Physics to run an astronomy night! There will be telescopes, pizza, friends, and the chance to meet the physicists of WA.

Study sessions
Date: Every week on Wednesday
Time: 12:00-14:00
Venue: 301.147 (physics seminar room)
Join us for weekly study sessions; a chance to study individually, with your peers, or to connect with senior students. This semester, we are also working on constructing a 'space-time globe', so you can come get some hands-on experience and build something interesting.

PhysClub Feud*
Date: TBC
Time: TBC
Venue: TBC
We are planning a night of "friendly" competition during week 9. Gather your friends and compete in a series of ridiculous games to determine, once and for all, who really is Brendan's favourite student.

*Being planned, but subject to change.

Common room updates
Connor 'Buzz' Brede and Nat Langford

A new fridge has arrived, please feel free to use this fridge for your personal food and beverages. Some items have been restocked in the club fridge and the pantry, please use the milk, tea and coffee freely.

We understand how annoying it can be to realise you left your pencil case at home when you have class or a test that day (we've all been there). Therefore, we have put together a collection of various stationery items (pencils, pens, highlighters, rulers, etc) for those tricky situations! Items belonging to the Curtin Physics Club are marked with red paint. You can find the Stationery Library behind the door of the common room. Feel free to use them while in the common room or take them with you to class or your exam. Just remember to bring them back afterwards!

If you have any suggestions for how we can improve the common room, please reach out to a committee member!

The new common room Stationery Library.

Book suggestions

Reading can be an enjoyable and restful way to take a break from studying. Here are our top recommendations for this month:

Letters from an Astrophysicist by Neil deGrasse Tyson
I know what you're thinking: 'Astrophysics? That's for nerds!'* You are of course correct, dear reader, but let's not be hasty, for astrophysicists are also masters of the written word. There is no better example of this than the man, the myth, Neil deGrasse Tyson, in his book *Letters from an Astrophysicist.* This short book is a collection of Neil's favourite letters, emails and other correspondences over a period of about 20 years. They are good, bite-sized entries covering Neil's thoughts and responses on a wide range of topics.

Every Living Thing by Jason Roberts
It is easy to forget how much knowledge we take for granted. *Every Living Thing* explores the life and works of two eighteenth-century men, Carl Linnaeus and Louis de Buffon, as they fought to lay the foundations of what we now know as biology. Their wildly opposing views on the staticity and order of life, and the societal response to them, offer insights on how the science we grew up with was shaped, and how prejudice disguised as intellect has deeply damaged the world. Jason Roberts weaves an insightful and well-researched tale that offers you a chance to meet your new favourite animal, the Vegetable Lamb of Tartary.

*Note from the editor: Greg's views on astrophysics do not represent those of The Essential Singularity or Curtin Physics Club.

Quiz

1. The Michelson-Morley experiment failed to confirm the existence of what?

2. What was the topic of Stephen Hawking's PhD?

3. What does the 'S' stand for in 'S matrix'?

4. In a vacuum, how is the electric displacement field related to the electric field?

5. What is a matrix called if its inverse is equal to its adjoint?

Answers:
1. *The luminiferous aether*
2. *Properties of expanding universes*
3. *Scattering*
4. *They are proportional*
5. *Unitary*

Quote of the month

"There are only so many derived types I can handle without tea."

- Kyna Schrick

Joke of the month

What do you get by crossing a mountain climber with a mosquito?
It is impossible. Scalars can't be crossed with vectors.

Interesting fact

Werner Heisenberg developed the matrix mechanics formulation of QM while on a tiny island in the North Sea, called Helgoland, after fleeing there to avoid hay fever! For further reading, I recommend 'Helgoland' by Carlo Rovelli.

Puzzle
Edward Mirco

Bob, after losing minigolf to Alice, launches into a frenzy, and attempts to snatch Alice's recovered scorecard. Fortunately, he is stuck in a lazy river encircling Alice's initial position with a fixed radius of 4m. Given that Bob can wade at a speed of 2m/s (and can turn instantaneously), what is the slowest (constant) speed Alice must run at to evade Bob? *Hint: It's less than $2/\pi$ m/s.*

Bonus: What is the minimum time Alice must run at this speed to evade Bob?

Bob

4m
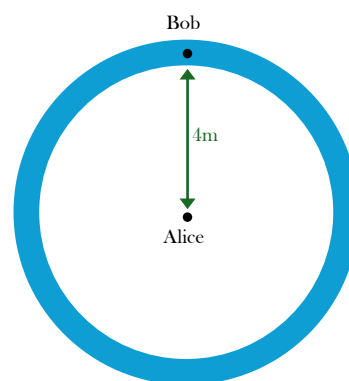
Alice

Answer to the previous puzzle

Alice finished on 80 and Bob finished on 89.

Full solutions can be found on the Curtin Physics Club website:
http://curtinphysics.tidyhq.com

Do you have something you'd like to contribute? We'd love to hear from you!

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Word search

Theme: Electromagnetism

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N  D  D  W  A  U  F  G  P  W  N  G  A  O  B
H  U  I  M  P  A  Q  H  A  H  J  M  M  E  C
V  U  P  J  R  O  A  U  M  U  A  V  P  G  M
K  A  Z  A  N  K  T  T  D  G  S  T  E  E  V
I  I  D  C  U  R  R  E  N  T  T  S  R  L  J
E  A  J  M  G  A  D  E  N  N  B  F  E  E  U
Y  Q  W  Q  H  F  T  U  O  T  M  W  E  C  A
L  H  G  I  A  I  G  F  F  R  I  B  H  T  X
I  J  U  H  C  W  S  U  K  H  T  A  E  R  U
K  C  G  Q  E  V  Q  T  B  G  O  G  L  I  L
M  N  L  Q  J  G  U  J  A  R  R  U  O  C  F
H  Y  T  I  L  A  U  D  J  A  L  S  T  W  P
L  L  E  W  X  A  M  A  H  Q  Q  F  D  O  M
X  L  D  T  F  I  E  C  G  N  P  S  L  G  T
M  K  A  G  K  B  V  C  Q  N  P  H  N  T  L
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Ampere	Charge	Current
Duality	Electric	Faraday
Flux	Gauge	Gauss
Magnetic	Maxwell	Potential