



 JEREMY

Q+A with
Professor
Stephen
Bartlett

Overheard
in A28

STAR TREK™
PICARD

(Star Trek: Picard Original Key Art Premium Poster, 2020)

PhySoc Response to COVID19

Hi Everyone,

You've likely heard by now that the University has advised all student clubs and societies to cancel or defer on campus activities or gatherings in light of the ongoing COVID19 pandemic.

In line with this, it is with a heavy heart that we inform you that PhySoc will not be holding any events until further notice. Any previously announced events will not be going ahead.

Our first and foremost priority in this is the safety of our members.

One of our goals as a society has been trying to foster a sense of community amongst physics students. It pains us that we won't be able to do it in person - we had a lot of things in the works. That being said, we hope that we can continue to foster a sense of community online. The digital edition of Jeremy will be published as normal every fortnight at usydphysoc.org.au/jeremy, and make sure to keep your eyes peeled for content on our social media channels.

All the best,

Justin, Emily, Riley, Fergus, Chloe, and Tom
The PhySoc Team

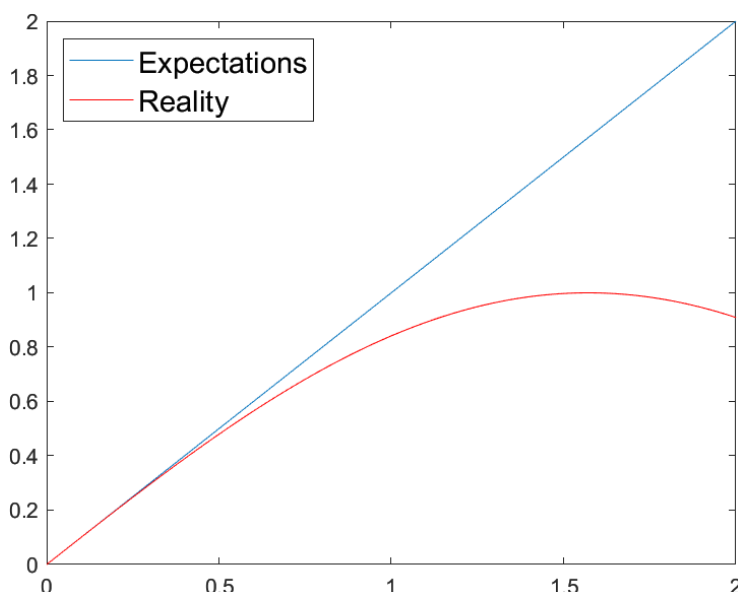
Overheard in A28

In order to better secure grant funding, the "Particle Physics" group has renamed itself to the "Quantum Fields Group". A lucrative deal with IBM has already been brokered and preparations are underway to secure the West wing of the physics building so that no students or staff can enter. Also, the windows will be replaced with yellow glass.

The broken doors at the backside of A28 are currently being repaired, after one of the doors fell over for the third time, in a moderate breeze. In order to avoid the same situation, *both* doors will now be replaced with immobile wooden plasterboard.

A third year lab student, working with the radio telescope on the roof of SNH, made a remarkable discovery. They noticed some sort of complex coded message originating from the Centauri system, embedded within their data. For their impressive work, the instructor gave them a mark of 65%, noting they did not bring their own radio telescope from home to check if the results were reliable.

- Zac



In Defence of Spherical Cows: The Implication of Approximation

The so-called "Theory of Everything" seeks to theoretically explain all physical phenomena in our Universe, but can such a theory really be perfect if it relies on our limited capacity to only observe reality through the lens of approximation?

Rather than say that "approximation" is not a legitimate demonstration of theoretical ideas, it should be recognised that our approximations of complex physical processes are done in a weighted manner, i.e. we only take into account factors essential to the final outcome. For example, in practice we focus on studying the theory behind "Universal Gravitation" rather than empirically observing all interactions between every mass in the Universe.

When we remove the inconsequential aspects we can explicate the central mechanisms of an otherwise complicated physical process. What becomes clearer is that the aim of theoretical physics may not be to describe all of reality, but instead to justify our a priori assumptions of the dominant mechanisms by which the whole Universe is governed.

- Vish

Picarding It Apart

The Science in CBS's Star Trek: Picard

Picard is the newest installation in the Star Trek universe that follows the adventures of the retired admiral, Jean Luc Picard as he voluntarily embarks on a personal mission to uncover the truth behind what happened when Mars blew up. So far, the show has released eight episodes, with more futuristic technology than ever seen before. Computer interfaces, electronic devices, have been improved upon to create a more seamless experience for their users and even research technology in the Star Trek universe has been accelerated to achieve what was so far only a distant dream.



Spoiler alert: Do not read this paragraph if you haven't watched "Remembrance".

We soon find out that Lieutenant Commander Data, a sentient android had a human daughter, Dahj. But how was it possible that synthetic life forms can have offspring? Specially sentient, human offspring? This was one of the major advancements made in the research on advanced synthetic lifeforms. Dr Bruce Maddox's radical idea of creating a sentient humanoid was at the core of developing a technique called fractal neuronic

cloning [1]. This technique can be used to create a complete android with a stable positronic matrix, all developed from a single positronic neuron of an existing neural network [2]. In other words, Data's positronic neurons were used to create a complete set of code, making a twin pair of 'clone' androids, Dahj being one of them. These humanoids also have the same memory as their parent android, Data, but they were only evident after the positronic neural network activates.

Image: Official Star Trek Shop. 2020. Star Trek X Rocklove Dahj & Soji Omega Necklace. [online] Available at: <<https://shop.startrek.com/products/star-trek-x-rocklove-dahj-soji-omega-necklace>> [Accessed 16 March 2020].

The synths also appeared completely human, made from human flesh and blood. Compared to the synthetic lifeforms that already existed so far in the Star Trek universe, these fully human sentient androids were more than just a few improvements to the existing technology.

The show's production designer Todd Cherniawsky was able to "miniaturize or create better interfaces for things that already exist" [3]. Things like interstellar communication, the transporter and even the replicator have still been reused in this series for the sake of continuation, however, they have been improved to be faster and create a much more smooth experience for their users. Compared to the tech today in Picard, the same equipment used in the Enterprise seems outdated, mostly due to the improved special effects over time.



Another wonderful improvement in Picard was on the computer systems, which have been further developed from the touch screen to holographic touch interfaces. These interfaces can now be operated to perform any kind of task from any device and are aesthetically impressive. The same kind of interface is also used in Cris Rios's civilian ship, La Sirena. According to Cherniawsky, this was inspired by the current research taking place in high-tech labs like Caltech and Oxford.

Naturally, real-world applications in the future may be inspired by these science-fiction technologies, especially devices using holographic interfaces based on light and touch may be created sooner than we expect.

-Thanvi

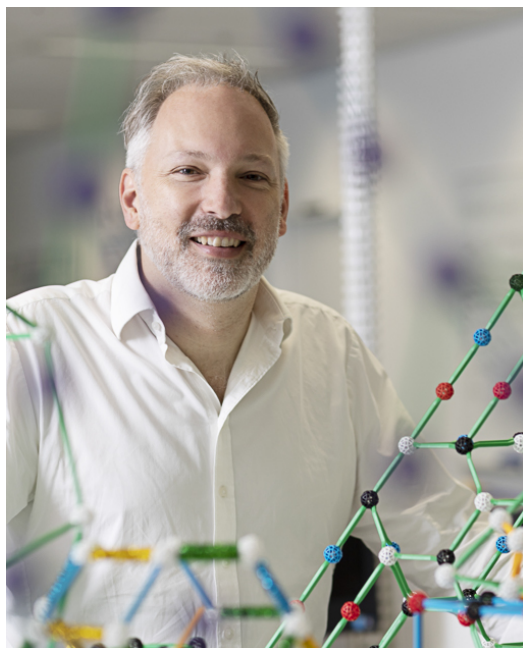
Got an idea for the next greatt article? Let us know at jeremy.physoc@gmail.com

Image credit: CBS

[1] Memory Alpha. 2020.Bruce Maddox. [online] Available at: <https://memory-alpha.fandom.com/wiki/Bruce_Maddox> [Accessed 16 March 2020].

Memory Alpha. 2020.Fractal Neuronic Cloning. [online] Available at: <https://memory-alpha.fandom.com/wiki/Fractal_neuronic_cloning> [Accessed 16 March 2020].

[3] Edwards, R., 2020.How Star Trek: Picard Creates The Tech Of The 24Th Century. [online] TechRadar. Available at: <<https://www.techradar.com/au/news/how-star-trek-picard-creates-the-tech-of-the-24th-century>> [Accessed 16 March 2020].



Stephen Bartlett

Field: Theoretical Quantum computing

If you could spend an hour with any person who has ever lived, who would it be and why?

“[sigh] I keep coming back to Einstein... there’s just so many questions for him!”

If you could only eat one dish for the rest of your life, what would it be?

“Ooh... I’d say a spicy curry, like a korma.”

How would you describe your research in ten seconds?

“I look at the theory of quantum computing, and what we’re trying to figure out there is how to utilise the exotic properties of quantum mechanics to build machines that can calculate and process information in completely different ways.”

What is your favourite aspect of your career?

“My favourite thing, definitely, is working with research students. That’s by far the most fun. The students here at Sydney Uni are fantastic—they’ve always got way better ideas than I do! It’s fun working out physics problems with research students, for all the reasons you guys like it in undergrad. I get to do that all the time, and it’s a lot of fun!”

What do you find most fascinating in your current field of research?

“What is really amazing is that physicists have discovered that some really exotic stuff can happen when you restrict the world down to two dimensions. We can actually do this in some quantum materials, so now we’re getting quantum mechanics and quantum electrodynamics in two dimensions. It’s really exotic—there’s new types of particles that are completely different to the particles we see in our three-dimensional world. It just turns out that those particles are really useful for building quantum computers, because they can keep their quantum properties for much longer—and they’re much more stable—than quantum particles that we find in 3-D. It’s just crazy that twenty years ago studying two dimensional universes was an esoteric, far, ‘out-there’, crazy idea in particle physics. Now we’re trying to build computers out of them, and that’s really cool!”

$$i\hbar \frac{\partial}{\partial t} \Psi = \hat{H} \Psi$$

If you could turn any activity into an Olympic sport, what would you earn a gold medal in?

"Talking! [laughter] But I don't know if I'm the gold medal winning type, to be honest!"

What's your favourite sci-fi movie, and why?

"You'll laugh, but I really like *Dune*. It's from 1984, based on the famous Frank Herbert sci-fi book. It's this movie made by David Lynch. It's just so weird and exotic, and it has such a great story."

If you were guaranteed the correct answer to any question, which question would you ask?

"How do we quantise gravity? That's the big one."

What would be the first thing you'd do after waking up from being cryogenically frozen for 200 years?

"Have physicists quantised gravity?!" [laughter] I need an update!"

What's something you'd like to accomplish next?

"I would love to make one big leap in my understanding of quantum mechanics. There's still so many confusing issues on what's real and what you know, and if I keep thinking, "Okay, what's the most important thing to do next?" I keep going back to questions on that. Quantum computers are going to be a thing, and I want to see them built. It's the fundamental questions on quantum mechanics that I feel compelled to come back to."

What's the best piece of advice you've ever received?

"Do what you like, and study what you like! Follow your passion with your studies, rather than thinking about a job or what's going to earn you the most money, or what you're going to do with it."

What's a skill you'd like to master?

"Having a big, long-term vision plan for what you wanna do and sticking to it!"

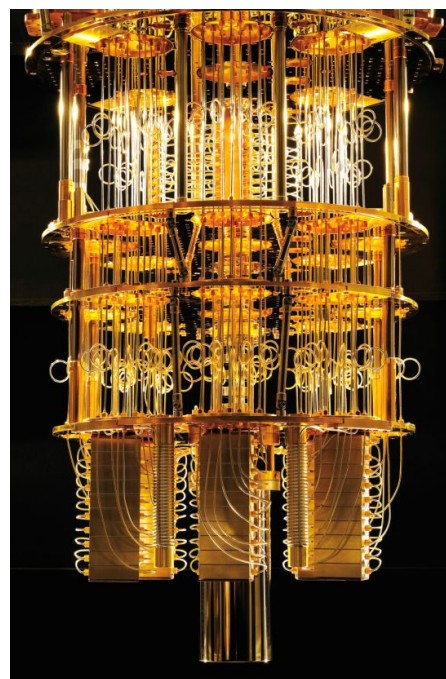
What or who inspired you to pursue your career?

"It was really quantum physics itself—all the confusion going back to Bohr, Einstein and Schrödinger—and that early-day story of quantum mechanics (and all the questions behind it) that got me hooked!"

What's your advice for every aspiring physicist?

"Have fun with physics! Enjoy the time you're studying and playing with it!"

- Interviewed by Lauren



(The quantum computer is about to change the world. Three Israelis are leading the revolution, 2020)

Why we need science fiction!

I'm sure as scientists, or people with a general interest in science (duh! You're reading this fabulous issue of Jeremy), there's nothing more painful than when science fiction movies get science horribly wrong.

BUT

Science fiction imagines worlds different to ours by envisioning new scientific discoveries and new technologies. Sometimes they're reasonable. Other times, they're just blatant fiction (or currently so!).

Bold and dramatic ideas so different from the current world around us inspires where we could go next - in both the possible and (for now) the seemingly impossible. Think about life on other planets! Given the number of NASA shirts worn in the physics building I think it's a fair assumption we've all been (even just a little bit) inspired by exploration of The Final Frontier.

So really, science fiction is just a way for us to think about what we could do, or why we couldn't. For the most part it's a good way to flex your knowledge on your non-science counterparts, or maybe it's just a great revision tool- because surely watching Antman counts as revising for Quantum??

-Sophia



Left: Andy Park/Marvel Studios

ARE YOU A REDFERN FAST WALKER?

Score a point for each of your Redfern walking traits and find out if you're a Redfern fast walker!

- ❑ You consider factoring in relativistic effects when calculating the time it takes you to get to class due to the speed you move at.
- ❑ You don't play any sport since you get enough high intensity exercise getting to class.
- ❑ You purchased Nike Alphaflys to get you to class 4-5% faster.
- ❑ Everyone else's clocks seem to move slower since you're moving so fast relative to them.
- ❑ You constantly calculate your walking trajectory up to 10m ahead of you.
- ❑ On the train, you calculate the most efficient speed to minimize energy cost and air resistance.
- ❑ Arriving at Redfern at 9:55am means you'll be early for your 10:00am lecture in the physics building.
- ❑ Instead of talking to your physics friends, you use their slipstream to get an aerodynamic advantage.

If you scored **less than 6**, keep to the left slowpoke!

If you scored **more than 6**, you are a speed demon! If you can't brag about your Uni marks, at least you can brag about your sub 10 to Nano from Redfern in non-ideal conditions.

-Connor

Interested in writing for Jeremy? Send us your ideas at jeremy.physoc@gmail.com

Right: Google maps