



ARC CENTRE OF EXCELLENCE IN  
FUTURE LOW-ENERGY  
ELECTRONICS TECHNOLOGIES

## FLEET News: April 2021

There's lots of work going on behind the scenes this month as we prepare for FLEET's mid-term review. We're very grateful to partners and collaborators who've agreed to be interviewed by the panel, or have written submissions to the ARC.



And a big thank you to everyone we work with who has helped to get us to where we are today – we have so many accomplishments to be proud of, and I'm looking forward to a strong showing at our review. ([See our new video submission below.](#))

This month's newsletter explores transparent electronics at RMIT and 'sweet spot' hole-qubits at UNSW, sees UOW's Zengji Yue explain some of his 'tricks of the trade', and describes a collaborative study confirming the potential of topological transistors to 'beat' Boltzmann's theoretical lowest computer operating voltage.

Regards,  
Prof Michael Fuhrer  
Director, FLEET

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### In this edition:

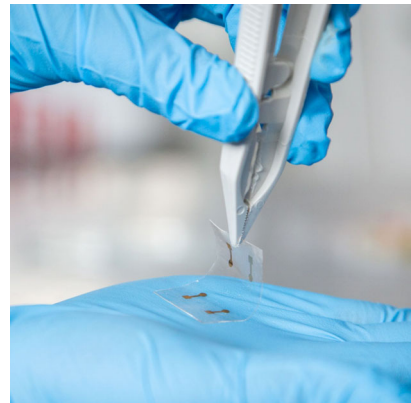
- [A positive approach to transparent electronics](#) (RMIT)
- [Hole qubits offer speed/coherence sweet spot](#) (UNSW)
- [Tools of the trade: Zengji explains ion intercalation](#) (UOW)
- [Beating Boltzmann with topological transistors](#) (UNSW, UOW, Monash)
- [Melbourne Knowledge Week](#) (SUT, RMIT, Monash)

- [Kirrily Rule, ANSTO nanoparticle cancer research](#)
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## A 'positive' approach to transparent electronics

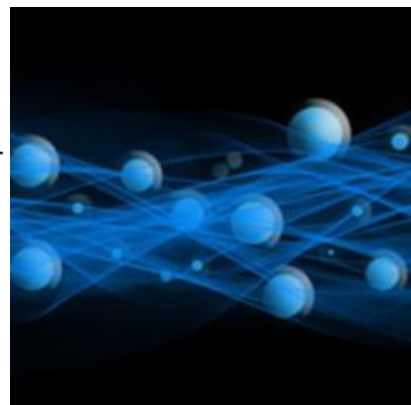
A new 'positive' approach could be the key to next-generation flexible, transparent electronics. The RMIT-led team introduce ultrathin beta-tellurite to the two-dimensional (2D) semiconducting material family, providing an answer to a decades-long search for a high mobility p-type oxide. [Read more online.](#)



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## Hole qubits offer speed/coherence sweet spot

Holes could be the solution to a long-standing operational trade-off, potential allowing scaling up of qubits to a mini-quantum computer. FLEET PhD Zhanning Wang and CI Dimi Culcer at UNSW led this study which finds that qubits composed of holes offer lower noise and increased coherence: a possible solution to a long-standing trade-off between speed and coherence. [Read more online](#)



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## Tools of the Trade: new explainer on ion injection

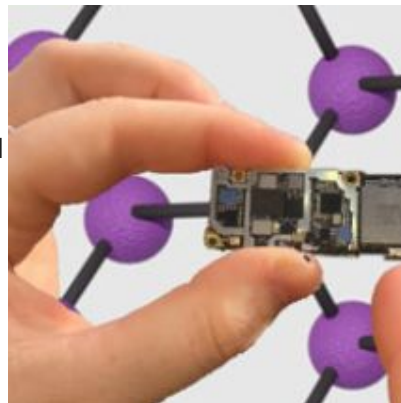
UOW's Zengji Yue wrote an explainer in the new Nature series 'Tools of the Trade', covering the intercalation of ions into or between atomically-thin materials to fine-tune properties or exfoliate 2D layers. The new series, spotlighting experimental and theoretical/computational methods, will feature a few other FLEET personnel in the coming months.

[Read more online.](#)



## Topological materials beat Boltzmann's tyranny

A new FLEET collaboration confirms the potential for topological materials to substantially reduce the energy consumed by computing. The UNSW-UOW-Monash study showed that electronics based on topological insulators rather than conventional semiconductors can reduce transistor switching energy by a factor of four, in the process defeating the famous Boltzmann's tyranny, which puts a lower limit on operating voltage. [Read more online.](#)



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## FLEET at Melbourne Knowledge Week

Melbourne Knowledge Week (26 April-2 May) is an opportunity for FLEET to engage with the public about the exciting future of computing, and a large cohort of Centre members from the three Victorian unis are staffing the superconducting Mobius strip and talking to public about a sustainable future for computing. If you're in the neighbourhood, pop in and say hi. [Details online.](#)



We're a little bit excited about running our first major, in-person science-outreach event in quite some time!

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## PI Kirrily Rule describes nanoparticle cancer research at ANSTO

FLEET PI Kirrily Rule (ANSTO) was in the news this month describing how magnetism experiments supported University of Wollongong research on silver-doped nanoparticles as a potential therapy for brain cancers.

[Read more online](#)

[Or watch Kirrily's interview on youtube..](#)



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## FLEET's annual report

FLEET's 2020 annual report is now online at [AR2020.FLEET.org.au](https://AR2020.FLEET.org.au) detailing an extraordinary level of scientific output last year, as well as FLEET's response to COVID-19.

The new online format is much easier to navigate and share with others (just share the relevant page's URL), as well as being a bit gentler on the planet.

Thanks everyone who helped us source content, allowed us to use their images, and especially those who actually did all the great work featured inside the pages.



## Catch-up on FLEET talks this month

If you missed Aydin's March seminar, you can **catch up on youtube**. Aydin explained strong nonlinearity in Dirac materials, allowing exploration of non-perturbative, very high field limit of quantum electrodynamics in solids, proposing experiments and discussing applications in novel materials.



You can also catch up on Eugene Demler's **April trans-Pacific talk** on quantum simulators.

From last month:

- **Research commercialisation** (Erol Harvey)
- **Reservoir computing** (Mikhail Kostylev)
- **Topological physics at the light-matter interface** (Gil Refael)

## Equity and diversity at FLEET

Help FLEET celebrate diversity by marking specific national and/or international days. **Please suggest** cultural days or other diversity events the Centre could celebrate.

This week is **Lesbian visibility week** so catch up with your lesbian friends, celebrate with them and check out **lots of other suggestions** to support.

**A DCA talk coming up on 11 May** will discuss actions to prevent workplace sexual harassment.

**A new (April 2021) Nature study** by Lisa Kewley (ASTRO3D) documents the historically low representation and progression of women in astronomy and models different initiatives to address it.

## Congratulations to our ECR authors this month

Congratulations to Ali Zavabeti (alum), Elizabeth Marcellina (alum), Qingdong Ou, Patjaree Aukarasereenont, Eliezer Estrecho, Nadeem Muhammad, Maciej Pieczarka, Matthias Wurdack, Iolanda Di Bernado and Zhanning Wang ... who are first or second authors in our most-recent publications.



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## Grants and opportunities

What grants or award/development opportunities are you aware of, now or in the near future? Let us know via [email](#), and we'll add them to future newsletters and FLEET's running [grants page](#).

**FameLab** is a global science-communication competition for early-career researchers in STEM. Applications close end April.

[Apply online](#).



**Pint of Science** is looking for both volunteers and speakers for Pint of Science in May, which will be online again in 2021. [Details online](#).

**Physics in the Pub** is back in an actual physical pub, in Canberra, and seeking presenters also for May. [See details online](#).

For other outreach/development opportunities see [Techgirls coaching](#), [In2science](#) mentoring, and [CSIRO STEM Professionals in Schools](#).

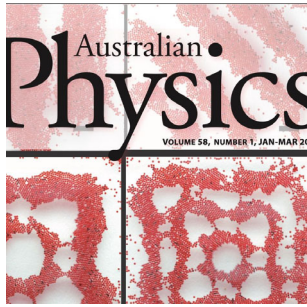
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## Previous news

**Target acquired!** Pavel Kolesnichenko led a Swinburne study teaching machines to identify imperfections in 2D materials just as Arnie could discriminate between “clothes, boots, a motorcycle”. The simple, automated optical identification of fundamentally different physical areas on these materials via machine learning could significantly accelerate the study of atomically-thin materials. [Read more online](#)







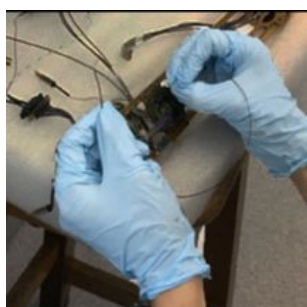
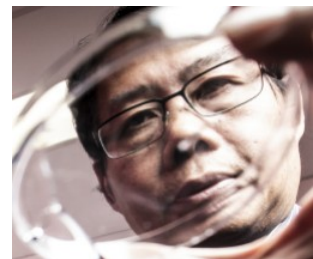
**Australian Physics article features vortex ordering at UQ** Grab the latest copy of the AIP's *Australian Physics* magazine to read an article written by FLEET-UQ's Oliver Stockdale, Matt Reeves and Matt Davis about vortex ordering in 2D superfluids. AIP members can access the edition [online](#).

**FLEET PhD students hit the airwaves** Three FLEET PhD students last month featured on popular radio science show Einstein a go-go's regular "20 PhDs in 20 minutes" segment. In this format, student and host each get a minute, covering the student's entire project in just two minutes combined. [Listen online](#)



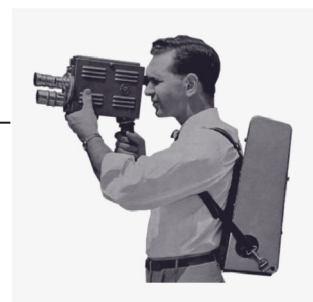
**APS presentations** FLEET was extremely active in the online APS March Meeting. [Check the list online](#) for FLEET members and affiliates who presented, and if you registered for the conference, you can click-through for catch-up videos via each presenter's page.

**Thermoelectric funding at UOW** FLEET CI Xiaolin Wang's breakthrough thermoelectric materials work with Zengji Yue, David Cortie (UOW) and Kirrily Rule (ANSTO) has been profiled in a University of Wollongong article about new ARC funding for energy projects. [Read the article online](#).



**UNSW summer students** Alex Hamilton's QED-UNSW group recently hosted four summer students, working alongside FLEET and Sydney Quantum researchers on their own, 6-week 'hands-on' nanofabrication & characterisation projects. [Meet the students online](#)

**Watch the new FLEET video** A new FLEET video spells out the Centre's central challenge—seeking a sustainable future for computing—as well as spotlighting a couple of research threads within FLEET (we only had time to give a taster, sorry!), and the Centre's wider efforts in equity and outreach. Feedback is very welcome! [Please watch the video online](#), and feel free to share with your networks (eg, via [LinkedIn](#)).



**Semiconductor decadal plan** If you missed the SRC's April 17 discussion re the importance of—and paths toward—future, energy-efficient computing, you can [catch up online](#).

The recently released **decadal semiconductor plan** identified five 'seismic shift's: major challenges to semiconductors and computing. No. 5: an imbalance between future compute energy and available global energy production—was clearly very relevant to FLEET's mission.

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## Participating organisations

FLEET is The Australian Research Council Centre of Excellence in Future Low-Energy Electronics Technologies. Read more about our **participating nodes** and **partners** online.

