Reviews

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View the article online for updates and enhancements.
John Kinchin describes a book that has had a lasting impact on him

Banesh Hoffmann weaves the story of the birth and development of quantum mechanics. Looking at the ultraviolet catastrophe and Planck’s first attempts at solving the problem of explaining the black body spectrum by the quantisation of energy, he guides us through the problems of wave particle duality and the arguments that split the physics community. We are taken through the work of Bohr, Maxwell, Pauli, de Broglie, Heisenberg, Schrodinger and Dirac. Hoffmann throws in other key players, too numerous to mention, in developments that spanned the years from 1887 until the postscript written in 1959.

The Strange Story of the Quantum describes the twists and turns, the dead ends and the great leaps forward that have resulted in the physics we know today. Hoffmann keeps you on the edge of your seat, presenting it almost like a detective story: we know who did it, but not who was implicated in the great journey. He names heroes and villains, those who reach great heights then fall from grace and the bit players who contributed to the great debate. As a young student it was captivating! The book awoke a passion which has been with me for over thirty years.

As a young A Level student I was intent on studying chemistry at university. My chemistry teacher, wanting to encourage my interest, lent me his copy of The Strange Story of the Quantum by Banesh Hoffman, initially published in 1947 and updated in 1959. It is fair to say that I devoured it, so much so that after a second read I decided that physics was what I wanted to study, not chemistry...and the rest is history!

Sadly I failed to return the book. My teacher and I parted company when he left the school and I never gave the book back, to my eternal shame.

After all these years, picking up the book again to prepare this review gave me great pleasure. I began re-reading the book one Sunday morning and reached the postscript several hours later. It brought back vivid memories of physics lectures, beer on the lawn outside the union, my friends and I discussing quantum mechanics and struggling to understand it. Coincidentally, on the day I finished reading it for the umpteenth time, the first picture of a ‘wavicle’, a name coined by Eddington popped into my Facebook inbox!
The world has moved on, but this book, along with my physics teachers, changed my career and sparked a love of physics that remains today. My old, stolen copy still resides on the shelf above my office desk, a little battered and read in turn by several of my students who have also gone on to study physics at a higher level. Seeing it there reminds me why I will remain a physics teacher until I retire!

**Journal: Philosophical Transactions A**

Celebrating 350 years of Philosophical Transactions

*Philosophical Transactions*, published by The Royal Society, was the world’s first journal dedicated to science. Launched in March 1665 by Henry Oldenburg, the Society’s first Secretary, it pioneered the concepts of scientific priority and peer review. By the late 19th century the pace of scientific discoveries led to the journal being published separately in two components, *Transactions A* covering physical, mathematical or engineering sciences and *Transactions B* covering the life sciences.

This special anniversary issue of *Philosophical Transactions A* highlights some of the ground-breaking papers published in the journal during its 350 year history. Each paper is discussed by a current leading scientist in the field, who tells us how the paper has impacted modern thinking and understanding, and how that field has developed to where we are today.

In his introduction, editor Dave Garner (Nottingham University) gives an overview of the history of the journal and the selection criteria for the 16 landmark papers included in this issue. I’ll give just four examples from the 16 papers, which are all fascinating.

Patricia Fara (Cambridge University) writes about Newton’s 1672 letter ‘containing his new theory about light and colours’. She describes its context in the history of ideas about light and colour, the four-staged argument in Newton’s letter, and its scientific consequences. ‘Whereas previous theories had taken white light for granted and tried to explain how colours are formed, Newton reversed the position by assuming that colour is a basic property that can be used to explain white light.’

Emily Winterburn (University of Leeds) writes about Caroline Herschel’s 1787 letter ‘An account of a new comet’, pointing out how the language Herschel used shows ‘her awareness of both the proper codes of conduct for women and the expectations of the scientific community’, in other words, ‘how she went about negotiating a place for herself in the scientific world’. Winterburn also describes contemporary cometary research and studies of women in science.

Jim Al-Khalili (University of Surrey) writes about Faraday’s paradigm-shifting 1832 paper ‘Experimental researches in electricity’, discussing what was understood about electromagnetism before Faraday, Faraday’s route into scientific research, his experiments on electromagnetic induction (including the induction ring that he
invented, the very first electrical transformer) and its scientific impact and world-changing applications.

John Young (University of Cambridge) writes about James Joule’s 1850 paper ‘On the mechanical equivalent of heat’, placing it in the context of earlier scientific work (especially that of Sadi Carnot). He describes Joule’s painstaking series of experiments through the 1840s, including Joule’s paddle-wheel experiments, ‘the most famous of his conservation-of-energy experiments because, as we now know, it gave the most accurate measurements for the mechanical equivalent of heat.’ Before going on to discuss Joule’s legacy, the author discusses the conclusions in Joule’s paper and also the referee report written by Michael Faraday.

Any collection of papers has the added advantage that you can read one at a time, absorbing it properly before making time to read another. This anniversary issue of Philosophical Transactions A is a fantastic resource for physics teachers, enabling them to present some key concepts in a proper historical context. It also provides valuable source material for textbook authors and for examiners.

Peter Campbell

We Recommend

Celebrating 350 years of Philosophical Transactions: physical sciences papers

Themed issue compiled and edited by Dave Gardner

Rating: ★★★★★


All featured archive papers for Phil. Trans. A (physical sciences) are available at http://rsta.royalsocietypublishing.org/content/373/2039. Some of the papers include supplementary archive material, such as scans of the original manuscripts, minutes from the meetings that papers were read at, and early referee reports. These will be freely available until the end of 2016.

Read about the history of Phil. Trans. here: https://royalsociety.org/publishing350/history-philosophical-transactions/. An anniversary issue for Phil. Trans. B (life sciences) is also available online.

Book: Crystal Clear—The Autobiographies of Sir Lawrence and Lady Bragg

A centenary publication

In 1915 William Henry Bragg (WHB) and his son William Lawrence Bragg (WLB) shared the Nobel Prize in Physics, for showing how the arrangement of atoms in a crystal can be deduced from x-ray diffraction patterns. WLB, who was only 25 at the time, received a telegram about his award while serving at the front in France during WWI.

This unusual book brings together memoirs written by three members of the William Lawrence Bragg family. Part 2 is WLB’s unfinished autobiography. Part 3 is the autobiography of his wife Alice, who was a public figure in her own right. WLB died in 1971, Alice in 1989. Part 1, ‘Meet my Mother and Father’, was more recently written by their youngest daughter Patience.

As Mike Glazer, the book’s main editor, points out in his Foreword, the Braggs ‘... jointly ushered in an entirely new scientific discipline, known as x-ray crystallography. It is a subject that has enabled scientists to determine the structures of thousands of crystals, starting from the very simple to the most complex of materials.’ X-ray analysis created entirely new foundations for chemistry, mineralogy and metallurgy. It also created a new discipline, molecular biology, by
solving the structure of proteins, viruses and, most famously, DNA.

Remarkably, most of the first generation x-ray crystallographers in the UK received their training either at Manchester, under WLB, or at the Royal Institution, under WHB. ‘More than 26 Nobel Prizes have been awarded for research that has built upon the work of the two Braggs.’

Today over 30000 people use crystallographic techniques in their work.

Glazer, an Emeritus Professor of Physics at Oxford University, briefly describes the scientific developments which created the field of x-ray crystallography, his own encounters with WLB and how he became involved in this book project. The Braggs built on what was then recent scientific work by Wilhelm Roentgen and Max Laue. Roentgen had discovered x-rays in 1895, leading to his 1901 Nobel Prize in Physics. Max Laue was the first to experiment with x-ray diffraction. Using a ZnS crystal in 1912, he obtained a pattern of spots on photographic film, and so won the 1914 Nobel Prize in Physics.

The book contains many charming drawings and sketches done by WLB, mainly of houses, landscapes and people. Glazer makes this interesting observation: ‘WHB, his wife Gwendoline, WLB and his sister Gwendy were all competent amateur artists…. I think that it was this artistic tendency that enabled WLB, at such a young age, to see the solution to Laue’s crystal diffraction problem, where the more formal approach of the German scientists struggled. Crystallography is by its nature both highly mathematical and a visual subject!’

Part 1 is a daughter’s insightful view of her parents, as individual characters and as a team, describing also their work and the family homes over the years. The publisher makes the the whole of this delightful account freely available online, as a book sample (http://fdslive.oup.com/www.oup.com/academic/pdf/13/9780198744306.pdf).

Part 2, at 185 pages is the longest part of the book, and is mainly about WLB’s generally happy personal life, beginning with ‘Growing up in Australia’. He extensively but rather cursorily recounts enjoyable travels abroad, attending conferences, giving lectures or visiting leading scientists, and family vacations in the UK. At one point Lawrence confesses that ‘I was often torn between the research and Alice, feeling that I was failing her wretchedly as a companion when I was hot on the chase.’ This, I suggest, puts foreign travel and family holidays in context.

There are some good descriptions of his scientific work, particularly military research during two world wars and the work that won him a Nobel Prize. Max Laue had thought of x-rays as being of a particular wavelength, whereas WLB regarded their spectrum as continuous. Laue assumed ZnS had a cubic lattice. WLB spotted that they might have a face-centred lattice and, in November 1912, used what subsequently became known as the ‘Bragg equation’ \( n\lambda = 2d\sin\theta \), to explain Laue’s pattern of dots.

WHB subsequently built an x-ray spectrometer and was able to identify x-ray spectra. WLB then solved the structure of NaCl. Father and son continued their research through 1913 and 1914, until the War intervened, investigating x-ray spectra and identifying crystal structures. The structure of diamond was largely solved by WHB, while WLB solved fluorspar, iron pyrites, dolomite and metallic copper. At a time when not even adding machines had yet been invented, this involved a phenomenal amount of calculating by hand.

Part 3 is Alice’s fluent autobiography. She starts with a detailed family history, beginning with her grandparents, 40 pages that are unlikely
to interest many readers. In her remaining 50 pages, she describes how she and WLB met and married, giving highlights from their life together. Alice had excellent social skills which Lawrence lacked. During WW2 she worked with the Women’s Voluntary Service for Civil Defence, gaining a wider experience of life, as well as skills in organising and public speaking. After the war she became a Cambridge councillor and was Mayor of Cambridge for a year. This led on to a series of important voluntary roles, as a local magistrate, as a member of the government Advisory Committee on Legal Aid and later of a Royal Commission on Marriage and Divorce. For many years she was National Chairman of the Marriage Guidance Council.

Both Lawrence and Alice discuss the succession of his prominent roles in British science, incidentally shedding light on how the scientific community both worked and played during that period. There were, for example, several years when Fellows of the Royal Society effectively boycotted the Royal Institution. In 1919 WLB succeeded Rutherford as Professor of Physics at the University of Manchester. Elected Fellow of the Royal Society in 1921 (also the year that they married), he was Director of the National Physical Laboratory in 1937–1938 and Cavendish Professor of Experimental Physics, Cambridge, from 1938 to 1953 (when Crick and Watson solved the structure of DNA). During this period he originated the bubble raft as a way of modelling the behaviour of polycrystalline metals. He became Director of Research at the Royal Institution from 1954 to 1966, where he initiated a popular programme of schools lectures that still runs today.

A single page with ‘Suggestions for further reading’ includes two Bragg biographies from the same publisher, Graeme Hunter (OUP, 2004) Light is a Messenger (about William Lawrence Bragg) and John Jenkin (OUP, 2008) William and Lawrence Bragg, father and son. It does not mention the Max Perutz collection of essays (OUP, 1998) I wish I’d made you angry earlier, among which is ‘How W L Bragg Invented X-ray Analysis’, a detailed account of the development of x-ray analysis well worth reading. Perutz joined the Cavendish Lab, Cambridge as a crystallography research student in 1938, twenty-five years later finally solving (with John Kendrew) the structures of haemoglobin and myoglobin.

The only index in the book is a Name Index running to 7 pages. You might read Crystal Clear to see how the Braggs report on the many famous people with whom they crossed paths, for instance, Arrhenius, J D Bernal, Patrick Blackett, Arthur Eddington, Ralph Fowler, Dorothy Hodgkin, Piotr Kapitza, Kathleen Lonsdale, Martin Ryle and James Watson. Sadly most such entries in the text disappoint, by going no further than name-dropping; however, discussion about a few people does go deeper. Curiosity about WLB’s personal life, as he and his family saw it, would be a better reason to read this book.

Further reading:
(ii) Mike Glazer’s article about the crystallographer Kathleen Lonsdale, who was taught by WHB (Glazer A M 2015 There ain’t nothing like a Dame: a commentary on Lonsdale (1947) ‘Divergent beam x-ray photography of crystals’ Phil. Trans. R. Soc. A373 20140232).

Peter Campbell

WORTH A LOOK

Crystal Clear: The Autobiographies of Sir Lawrence and Lady Bragg
Edited by A M Glazer and Patience Thomson
Rating: ★★★
Price: £35
Details: Published in 2015 by Oxford University Press, 427 pp, including a name index. 70 b/w illustrations. Hardback ISBN 978 0 19 874430 6 (also available as an eBook).

All royalties for this book will be donated to support the Royal Institution of Great Britain.
The author of this book will be well known to those who follow his xkcd web comic of ‘romance, sarcasm, math and language’ (http://xkcd.com). As the sub-title of the book makes clear it is a compendium of ‘serious scientific answers to absurd hypothetical questions’. All the questions have been posed by fans of his web comic. There are fifty seven in all, plus a selection of ‘weird (and worrying) questions from the What If inbox’ (https://what-if.xkcd.com). The tone of the book is set by the author’s disclaimer (in small print!) ‘Do not try any of this at home. The author of this book is a web cartoonist not a health and safety expert. He likes it when things catch fire or explode, which means he does not have your best interests in mind.’

But the interests of your students are very well served, as you will glean many ideas to liven up the non-practical content of your teaching plans. There is a lot of good physics in this book, as well as forays into the other sciences. For example, answering the question ‘is human self fertilisation possible?’ contains an excellent primer on genetics.

In some ways the book is reminiscent of the Daedalus column that appeared for many years in New Scientist magazine. Those of you who like Fermi questions (http://mathforum.org/workshops/sum96/interdisc/classicfermi.html), or who treasure their copy of ‘Thinking Like a Physicist’ by Norman Thompson (IOP Publishing, 1987) will enjoy Munroe’s approach as a physicist, even if he is analysing the wackiest of questions. e.g. What would happen if you were to gather a mole (unit of measurement) of moles (the small furry critter) in one place? You will both marvel and laugh at the astronomical consequences. Other questions are closer to (a physicist’s) reality. For example, what would happen if you tried to hit a baseball pitched at 90% the speed of light? Or, what would happen if you made a periodic table out of cube shaped bricks, where each brick was made of the corresponding element?

There are many fascinating facts to discover: earthquakes alter Earth’s rotation period (and hence the length of the day); the Clarendon Laboratory in Oxford University has a battery powered bell that’s been ringing since 1840. I love it when I come across a new word. Apricity sent me to my Oxford English Dictionary (‘the warmth of sunlight in winter’). I was amazed to learn that there are $2 \times 10^{46}$ meaningful English language tweets, which poses the question as why was the tweet length of 140 characters chosen? And did you realise that the English alphabet has 27 characters?

The answers to the questions that have been posed are sometimes counterintuitive, and if you want to delve further into a particular topic there is a comprehensive list of references and sources used to find the answers.

You could dip in and out of this book—but I found it quite compulsive reading. You will no doubt have your own favourites amongst the topics that are discussed. You will probably start to look at the world in a rather different way.
too. Both the questions and the answers show lateral thinking and would serve as exemplar material on brainstorming. Generating multiple ideas no matter how crazy and exploring them has a much better chance of throwing up something useful, and thus of starting to solve any problem.

Why not think up your own question and maybe submit it to the website? The recent announcement that hydrogen sulphide becomes superconducting at just $-70$ °C (Nature, 3 September 2015, pp 73–6) made me wonder ‘What would happen if all metallic objects and wiring suddenly became superconducting?’

This is a book that is simultaneously humorous, fascinating, stimulating, thought provoking, addictive and subversively educational. Definitely one for your bookshelves (and a great idea as a gift for your physicist friends of all ages).

Rick Marshall

**Equipment: Skywatch Windoo 3**

*Weather when you want it*

Whilst not necessarily an everyday object for the physics teacher, a portable weather station can sometimes come in useful. The first thing to be amazed at is the small size of this unit, no bigger than an average thumb, the weather station boasts an anemometer, temperature, humidity and pressure sensor all of which plug into the microphone/earphone socket of an Android or iOS phone or tablet.

Once inserted and the app started up, the software first calibrates the device, it is essential that the volume on the phone/tablet is as loud as it can be to enable the voltage to be high enough to drive the device. Once calibrated the device works remarkably quickly and accurately. The device responded rapidly to changes.

The software is relatively basic. Readings can be saved using a disk symbol, but these can only be seen as a history of readings or uploaded to the internet and viewed on a world map. My attempts at the latter were not totally successful; however there is plenty of evidence to show that others have not had a problem. It is possible to add a photo with your uploaded readings. The measurement units are fully customisable and there is a wide range available.

I was pleasantly surprised by its simplicity, and how easy it packed into my rucksack on a recent expedition to South Wales, sadly even this unit is not happy in a Welsh thunderstorm on top of the Brecon Beacons!
The only misgivings are not being able to download the data onto a computer. However, this is a minor gripe when one has a weather station that will fit in its own small but functional case. It may not be a traditional piece of physics equipment but because of its portability it would be very useful in investigations out in the field.

Tested on iPhone-4, iPad, Android (Ice Cream Sandwich or higher is required) phone and numerous Android tablets, all giving similar results.

John Kinchin

**WE RECOMMEND**

**Skywatch Windoo 3**  
*Instruments Direct (Services) Ltd*  
**Rating:** ★★★★★  
**Price:** £82.50  
**Details:** Available from [www.inds.co.uk/weather/windoo3.htm](http://www.inds.co.uk/weather/windoo3.htm), order code: WINDOO3.

**EQUIPMENT: VERNIER GO WIRELESS**

**Data logging on the go**

The early days of data logging equipment saw limitations in the amount of storage space for data and more importantly connectivity to computing equipment. The latter made ‘in the field’ data acquisition a nightmare of logistics. With the advent of laptops and recently tablet computers field work is now simplicity in itself.

IDS, who distribute Vernier data logging equipment, have produced a series of probes and interfaces to link to tablet and desktop computers via a wireless (Bluetooth) link. The probes are self-powering, charging from a USB source. I charged these probes from an old mobile phone charger, but was successful in charging from a car USB supply, laptop and a power-bank. The probes charge rapidly and have yet to run out of charge whilst I was using them. The Vernier Graphical software is free of charge from the Vernier website, Google Play and The App Store and installs very quickly. It is very easy to use and learn and I was very quickly acquiring data and manipulating it, even without using any help files.
To use the probes, the software is started and an experiment started. Selecting the wireless probe (only one probe can be active at any time), the graph screen opens to allow a one click logging option. Once logging starts, the graph offers continuously varying scaling of both axes; logging for a short or long period of time is very easy. Once the data is acquired basic data manipulation is available. Viewing the table of results, line fitting and even the opportunity to allow users to write over the graph to predict or highlight certain key features. Multiple graphs were available and I noted that the graphs were automatically saved in use. Exporting data is relatively easy via the ‘share’ button allowing the data to be sent to a range of suitable pieces of software. Whilst X–Y plotting of two none time variables is not possible in the graphical software, exporting to a spreadsheet via the data table allows data manipulation; on both Android and Apple devices this was very easy allowing a full range of data analysis and X–Y plotting.

I found that the bluetooth range of the probes from the tablet varied; working in a laboratory, I could leave my tablet anywhere and pick up the data with ease. Leaving my tablet indoors and the probe outside was a little more problematical, however if there was a reasonable line of sight between the probe and tablet, I had no problems.
One nice feature is the Go Wireless adaptor allowing an older sensor (in this case anemometer) fitted with a telephone type plug, to be used with the wireless system. This worked with no problems and was running for at least 90 mins outside in windy conditions.

All three sensors, tested as part of the sample, worked very well. There were very few problems with connectivity, see above, and the probes connected to the software very quickly. Only once did a probe drop out of its link, and this was down to user error.

What impresses is the size of the probes and the ease of use. The probes are easily transported and were tested out in the field as well as the laboratory. The ability to charge from a power bank makes these probes very versatile.

As part of the Go Wireless system a multiple charger is available, there is also an impressive range of sensors available, the non Go Wireless ones being able to link in using the adaptor. My only concern is the limitation of one probe in use at any one time, this is the not the fault of the probes but the limitation on bluetooth connectivity. It must be remembered that the Go Wireless probes are only part of a much bigger range, which do not ‘suffer’ from this limitation.

John Kinchin

**Equipment: Energy Track**

**Loop-the-loops in the classroom**

Whilst teaching circular motion and basic mechanics, it is always good to give students examples that they can test in the real world. Whilst many schools still have curtain tracks, Matchbox or Hot Wheels tracks in their store cupboards, these can often be difficult to set up, especially if the small plastic supports have, as in my case, fallen apart through old age!

The DJB energy track is an inexpensive ramp with two individual tracks already to go and beautifully set up. With the aid of a couple of light gates, I used ones we already had in stock, the

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**Vernier Go Wireless Link**

*Instruments Direct (Services) Ltd*

**Rating:** ★★★★★

**Price:** Prices vary

**Details:** Available from [www.inds.co.uk/education/interfaces.htm](http://www.inds.co.uk/education/interfaces.htm).
range of investigations that can be carried out is varied and makes the purchase of this simple piece of apparatus worthwhile. The two ramps are solid and take ball bearings or marbles up to quite a large diameter. One track has a loop built into it of radius 10 cm, which allows a number of variations on energy changes to be investigated. Letting my students theoretically prove that to complete the loop-the-loop the minimum height must be \(5r/2\), then test it and find that what we have learnt about circular motion is correct, gave particular satisfaction. Investigating velocity and final kinetic energy gave good results as did showing that the final velocity didn’t depend on mass or route taken, only enhanced the learning and reinforcing the mathematical modelling that normally takes place. Sometimes simple is best and whilst this piece of apparatus could be deemed unnecessary, the simple fact that it is set up and ready to go from the box, saves 20 min of frustration when time for teachers is in short supply.

John Kinchin

WE RECOMMEND

Energy Track, B1-10000.50
DJB Microtech Ltd
Rating: ★★★★★ (just for simplicity and that it works)
Price: £49.20
Details: Available from www.djb.co.uk/ppm_energy_track.html.

WEB WATCH

Remote controlled telescopes

With the winter coming science and astronomy clubs will start up again. For a beginner nothing is better than naked eye observation but quite soon something else is needed. A simple telescope gives a good view of the moon and a slightly better telescope gives a good view of the planets. Although larger telescopes and better pictures are possible the English weather and school timetables make observation difficult. The solution is one of the remote controlled telescopes now available.
**Reviews**

They are much larger, being professional machines and much better located for effective observation. This leads to three possible telescope sites. The sites generally provide a library of previous images and the ability to command the telescope to take particular images.

www.faulkes-telescope.com/ started in UK but it is now part of a much larger USA project. There are several telescopes so most of the night sky is covered. There is a large archive. Even when the image has been obtained there is quite a lot to do identifying the object. Of the three sites reviewed it is probably the most difficult to use but has the most scope.

www.schoolsobservatory.org.uk/astro/tels/lt is sponsored by Liverpool University. The actual telescope is on La Palma. Requests for images are queued until there is a suitable opportunity for the observation. Obviously weather, the moon and so on would interfere. The computer running the telescope will also set the exposure to a suitable value and be as helpful as possible. This has the advantage that the probability of getting a suitable image is much increased but the disadvantage that students will not see the difficulties of actually making observations. The site has useful image processing software free for student use.

http://schools.telescope.org/login.php is a Bradford University project with the telescope at Tenerife. The site does not seem to have a public face and if you are interested you would need to contact the organizers. The contacts are on the web page above. There is a charge for this telescope (unlike the other two) but training at your school is provided.

http://us2.campaign-archive1.com/?u=7a8fbaaf70aa4b22de1242958&id=e0597174f7&c=c2d1bcdccc is a newsletter from UIT Cambridge a specialist non-fiction publisher. There are several interesting entries among them a blog post from David MacKay about offshore wind energy farms. There are several interesting looking entries on sustainable materials and solar power. This is possibly useful in lesson preparation.

Robert Strawson

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**Apps**

**Physics news**

We as teachers can enrich lessons by linking curriculum content to recent discoveries, current news and the world of work. But this is richer still, and often more relevant to the student, if the students bring questions about something they have read or heard to the classroom themselves. So read on to hear the pro’s and con’s of some of the physics news apps available for students to download...

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**Featured App: Science News & Discoveries**

This app takes news available free online from a variety of sources, and puts them into one place. Although it contains a variety of science and technology articles, it has a large percentage which have a physics focus. The app seamlessly takes you to the source website and allows you to view the content while staying within the app itself—so it feels as if your news is all in one place. The text scales well to the page, you can zoom and change font size as
needed, but thankfully you won’t end up playing that frustrating ‘side-ways scrolling game’ in your efforts to adjust the size of the text (familiar to those of us who go direct to websites not optimal for viewing on a phone or tablet). I am able to read content from phys.org in this app not available to me in the phys.org lite app, which speaks volumes. This app gives you clear sources and publication times, and refreshes regularly. I particularly like that you can opt to ‘always skip to site’ when you click, rather than just seeing the summary of the article. It has a number of customisable options which makes it more useful than other news reader apps I’ve tried, although admittedly there are plenty more available than those covered here. There are adverts, but they are neatly kept in their own area. This is a polished and professional app—and one that students will enjoy using to access physics news.

**APP: PHYS.ORG**

Phys.org publishes around 100 articles a day on its website across a range of disciplines relating to physics, technology and the sciences more broadly. The lite version of the app contains a limited set of those articles. The app has sections ‘spotlight news’, ‘feature stories’ and ‘weblog and reports’, and the full version allows you to browse by topic. Even the lite version allows you to click through to related stories, and the content is presented in the app in a format which includes diagrams and footnotes, and is easy to read. It also contains references at the end of an article, which is important to draw students attention to—it’s an added benefit if we can get students evaluating the sources of scientific news and thinking critically. Is it worth having when you could just go to your browser and read the full content? It’s difficult to say, and to a certain extent, it’s a personal choice. If it gets a student reading more physics-related news, it’s still worth a mention in my opinion.

**WE RECOMMEND**

**Science News & Discoveries**

*Developer/Seller: Newsfusion Ltd*

*Compatibility: Requires iOS 6.0 or later. Compatible with iPhone, iPad, and iPod touch. Also on Android.*

*Version Reviewed: 3.1.3*  
*Last Update: 1 July 2015*  
*Cost: Free*  
*Review: ★★★★★*

**Phys.org Science News Lite**

*Developer/Seller: Phys.org*

*Compatibility: Requires Android 1.6 and up.*

*Version Reviewed: 9.0.3*  
*Last Update: 17 January 2013*  
*Cost: Free ‘lite’ version*  
*Review: ★★★*
This app has very annoying full-page adverts as well as banner ads, which for me make it more trouble than it’s worth. However, there is plenty of interesting content, and it is otherwise a good way to read news content from a number of sources all in one place. The app doesn’t signify the source until you click through to the full article, which is a feature important for me—because there are some science news sites that are much less rigorous sources, and that I would generally encourage students to avoid or read with caution.

Rosie Boparai