REVIEW

Reviews

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A book that has stayed with me: Liz Swinbank

Liz Swinbank describes an ancient but still useful book

First, a confession; I rarely read non-fiction books for pleasure, and even more rarely do I read them cover to cover. Lucretius On the Nature of the Universe is one of the exceptions, which I bought and read as a first-year undergraduate with an extra-curricular interest in the history of science. Another is J D Bernal’s Science in History—a sweeping survey ranging from the flint hand-axe to the atomic bomb—but its four chunky volumes have made re-reading it a tall order.

I can’t remember now what prompted me to buy Lucretius—possibly he was cited by Bernal, maybe I just picked out the book from a bookshop display. But I do remember feeling quite excited at the prospect of reading it, an excitement enhanced by delayed gratification as the copy I had bought was misbound (some sections missing, others repeated and bound upside down) and there was the hassle of going back to the shop for a replacement.

The Roman poet Titus Lucretius Carus lived in the first century BC (c 100—50 BC). De Rerum Natura (On the Nature of Things or, as Latham prefers, On the Nature of the Universe) is a long poem in which he sets out to persuade his readers to adopt the teachings of the philosopher Epicurus, who was in turn influenced by Democritus and the Greek atomists. As described by E R Latham in the foreword to his translation, Epicurus advocated ‘salvation by common sense’. He was a scientific rationalist, maintaining that ‘modern science has disposed ... of the fairy tales that pleased our grandparents and the bogeys that frightened them’. He believed that ‘all knowledge is derived from the senses’, that ‘things are exactly as they appear to be to our senses, or rather as they would appear if our senses were ... more acute’, and sought to ‘explain everything we perceive without positing the existence of anything other than material objects and the space in which they move’.

It was this rationalist/materialist philosophy that appealed to me (still does). Reading Lucretius in the shade of large apple tree in my parents’ garden, I remember thinking yes, this is what physics is about: trying to explain the material world in terms of a relatively small number of fundamental material entities (‘atoms’) and their behaviour. That was not a completely new insight, but it crystallised and articulated the way I thought about doing physics—and that is what has stayed with me.

Some quotations from Lucretius found their way into the IOP’s Particle Physics resource package that I helped produce in the early 1990s. Since then, my copy had been lying dormant until a conversation with a colleague a week or so ago, about what the ancient Greeks thought (or did not think) about atoms, prompted me to blow off the dust and read it again.

Reading Lucretius now, what strikes me is how contemporary many of his descriptions and
explanations seem, and how the ancient philosopher-scientists have been given rather a bad press. Granted, they did not do ‘experiments’ as we now characterise them (quantitative predictions, tested in controlled conditions) but some of them did observe carefully and based their explanatory models on what they observed.

While Lucretius refers on occasion to earth, air, fire and water, he does so more as a metaphor for ‘everything that there is’ (solid, liquid, gas, ‘energy’) with its various properties, rather than suggesting that these ‘elements’ are fundamental constituents of matter. After demolishing the idea that everything is made of fire (attributed to Heraclitus), he goes on to say that ‘no less mistaken are those who think that everything can grow from four elements’ and provides several pages of argument to support his case. He then goes on to state his position: that ‘there exist certain bodies that are absolutely solid and indestructible, namely those atoms which, according to our teaching, are the seeds or prime units of things from which the whole universe is built up’.

Here are some quotations that, I suggest, would not seem very out of place in present-day science lessons as we talk about the particle model of matter and seek, through demonstration, argument and physical modelling, to persuade students of its usefulness and explanatory power:

‘... things that seem to us hard and stiff must be composed of deeply indented and hooked atoms and held firm by their intertwining branches. In the front rank of this class stand diamonds ... Liquids, on the other hand, must owe their fluid consistency to component atoms that are smooth and round. For poppy-seed can be poured as easily as if it were water ...’ (p 73)

‘Observe what happens when sunbeams are admitted into a building and shed light on shadowy places ... give your mind to these particles that are seen dancing in a sunbeam: their dancing is an actual indication of underlying movements of matter that are hidden from our sight. ... You must understand that they all derive this restlessness from the atoms, which move of themselves.

Then those small compound bodies ... are set in motion by the impact of their invisible blows ...’ (pp 62–64)

‘... the number of different forms of atom is finite. It if were not so, some of the atoms would have to be of infinite magnitude ... Consider how, in my verses, for instance, you see many letters common to many words; yet you must admit that different verses and words are composed of different letters ... So in other things, although many atoms are common to many substances, yet these substances may still differ in their composition.’ (p 74, p 80)

And, in similar vein, here are some extracts that discuss free fall and the origin of colour:

‘The reason why objects falling through water or thin air vary in speed according to their weight is simply that the matter composing water or air cannot obstruct all objects equally, but is forced to give way more speedily to heavier ones. But empty space can offer no resistance to any object in any quarter at any time, so as not to yield free passage as its nature demands. Therefore, through undisturbed vacuum all bodies must travel at equal speed though impelled by unequal weights.’ (p 67)

‘The primary particles of matter have no colour whatsoever ... it is through the variety of their shapes that they produce the whole range of colours, a great deal depending on their combinations and positions and their reciprocal motions ... a peacock’s tail, profusely illumined, changes colour as it is turned this way and that. These colours, then, are created by a particular incidence of light ... When a pupil of the eye is said to perceive the colour white, it experiences in fact a particular kind of impact ...’ (pp 81–84)

I could go on. Lucretius presents accounts and explanations of matters as diverse as cosmology (he argues that the universe must be infinite, and that it is likely to contain other worlds populated by intelligent beings), geology, the mind, sociology and sex. By no means would everything that he writes stand up today. For example, his
explanation of vision involves ‘very thin films’ being emitted from objects’ surfaces and entering our eyes, and he provides a detailed atomic explanation for the spontaneous generation of worms from dung. But his book is nevertheless a fascinating insight into a way of thinking about the world, and one that still resonates more than two millennia after it was written.

_Liz Swinbank_

**On the Nature of the Universe (Penguin Classics) paperback—26 May 1994** by Titus Lucretius Carus (author), John Godwin (introduction) and R E Latham (translator).

This is the latest edition of the translation that I read. There are several other translations, including a more recent one by Alicia Stallings (2007) for Penguin Classics.

Elizabeth Swinbank graduated from Cambridge University with a degree in Natural Sciences/Physics, after which she gained a PhD and PGCE and taught for 9 years in an 11–18 comprehensive school. She joined the University of York Science Education Group in 1990, where she has been involved in several curriculum projects and publications including Salters Horners Advanced Physics, Physics Review magazine and Perspectives on Science.

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**Book: An Einstein Encyclopaedia**

More than just an encyclopaedia

This book was published as part of the commemorations for the hundredth anniversary of the theory of general relativity in 2015. It is not designed to be read from cover to cover. However, it is much more than just an encyclopaedia. It must be the single most complete guide to Albert Einstein’s life and work for students, researchers, and browsers alike. It is compiled and written by three leading Einstein scholars who have drawn on their expertise gained during their work on the collected papers of Albert Einstein. In all, this book distils information from the 80,000 plus items in the Einstein archives.

The book is divided into three parts covering the personal, scientific, and public spheres of Einstein’s life. There are also several appendices with information that does not fit neatly into the three main parts (e.g. guides to reliable websites and the many books written about Einstein). There is also a detailed index that can pinpoint the page(s) dealing with virtually any query you may have.

The entries on Einstein’s scientific theories provide useful background and context, along with details about his assistants, collaborators, and rivals. Entries dealing with concepts related to his work are particularly useful, as they reveal the interconnectedness of physical ideas and theories. The discussions make a great refresher course for those of us whose physics degrees are now many years behind us. Personally, I now have

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a better understanding how my degree syllabus had been designed and why apparently unrelated topics were included in the particular order in which they were presented.

There are helpful commentaries on his papers and articles. Einstein’s interests went beyond relativity and quantum mechanics. His first published paper in 1901 dealt with capillarity. Other less well-known interests include a paper dealing with superconductivity (discovered 1911) as well as why rivers meander. He also worked on the design of a gyro compass to aid a submarine expedition to the North Pole led by Hermann Anschütz-Kaempfe. Magnetic compasses obviously do not work inside the metal hull of a submerged submarine. The connection with Anschütz-Kaempfe developed into a very fruitful working relationship and Einstein had a significant influence on the construction of the gyro compass.

Short biographies of his many colleagues comprise a roll call of the all famous physicists of the first half of the twentieth century. As well as his dealings with all the leading physicists of his time. Contrary to popular belief, Einstein collaborated over time with 33 assistants, many of whom shared the joint authorship of a resulting scientific paper.

All of Einstein’s major lectures are listed. However, the one that he gave at the University of Nottingham in 1933 was either not known to the authors or is not considered to be significant compared to the one he gave at Oxford University.

Coverage of Einstein’s role in public life includes entries on his Jewish identity, humanitarian and civil rights involvements, political and educational philosophies, as well as religion. The truth behind six popular myths about Einstein are laid bare, as well as his efforts as a poet.

Several mentions are made of Einstein’s love of sailing (even though he could not swim), but not his use of the boat house of his personal doctor and friend Janos Plesch, at the Villa Lemm on the Havel River at Gatow, south-west of Berlin. Janos Plesch also let Einstein make regular use of a cottage on their estate. It was here that Janos Plesch’s teenage son Peter got to know Einstein quite well. Peter subsequently provided your reviewer with much of the information contained in his 2005 article [1].

Readers of this journal will delight in the fact that Einstein’s initial career ambition was to be a school teacher. He graduated with a teaching diploma in maths and physics but could only find temporary posts and so after two years opted
for the financial security of his first permanent employment with the Swiss Patent Office. When you read the entries on his views about education you may well feel that he was a fine teacher [1].

Another thing of particular interest to UK readers that you will not learn from this book is that in 1933 Einstein lived in the Norfolk village of Roughton for a short while [2], en route for Princeton after leaving Germany. Mention is made of Einstein sitting for the sculptor Jacob Epstein nearby in Cromer.

Einstein must be the most celebrated and feted scientist yet. He received 35 awards and medals. Surprisingly he had to be nominated for a Nobel Prize nine times before being successful in 1921. The award ceremony actually took place in 1923. In the citation, relativity theory is only referred to obliquely, whereas his work on the photo-electric effect is clearly stated. Indeed it appears that during his working life, Einstein devoted more time to quantum mechanics than to relativity theories.

He received 23 honorary degrees and held 37 memberships of scientific academies and societies. One honour not listed in this encyclopedia is that Einstein accepted an invitation to be the Rector of Woolstanton Grammar School (Staffordshire, UK) Sixth Form Society [3].

Einstein has had an enormous scientific and public influence. By no means a saint, he displayed some human flaws. His interests went way beyond esoteric scientific theories. Unlike biographies of Einstein, this book allows the reader to get to know Einstein for themselves rather than mediated by the thoughts of a biographer.

Rick Marshall

References

We Recommend
An Einstein Encyclopaedia
Alice Calaprice, Daniel Kennefick, Robert Schulmann
Rating: ★★★★★
Price: £27.95
The author of this book, Svetlana Alexievich, is an investigative journalist from Belarus. She was awarded the Nobel Prize in Literature in 2015 for a body of work documenting the collapse of the Soviet Union including the war in Afghanistan. Her approach is to interview a great range of individuals and then to present these oral histories verbatim, leaving the reader to build their own picture of how ordinary people are affected by major world events.

I’m not sure that I would classify Alexievich’s work as literature, but Voices from Chernobyl certainly packs an emotional punch. It is also very revealing of people’s everyday knowledge and understanding of radioactivity and radiation, for anyone interested in teaching about these important parts of physics.

Reactor no. 4 at the Chernobyl plant in Ukraine blew up on 26 April 1986. The graphite core caught fire, spreading large amounts of radioactive material over the western USSR. In the mid-1990s Alexievich collected interviews from residents of Belarus, by then an independent state and the country most affected by the disaster. She recorded monologues and group discussions with a great variety of people—firemen, soldiers, farmers, relatives of those who died in the recovery operation. A widow describes the rapid progress of radiation sickness in her husband who worked on the roof of the reactor. A soldier tells of lining his helicopter seat with lead but is told that this will only protect him from ‘one type of radiation’.

Everyone drinks vodka as a protection against the effects of radiation.

In all, over half a million people were brought in to work on the recovery operation. From Alexievich’s interviews, it is clear that few were aware of the risks they were expected to run. Soldiers were glad to receive two or three times their regular pay. Some regarded it as a great honour to join the effort; others sought any way to avoid it. Dosimeters were available but not supplied to the majority—they would have passed the legal limit long before the end of their tour of duty. Iodine salts were also available in the neighbouring city of Pripyat, but they weren’t distributed for fear of causing panic. High levels of thyroid cancer in children are a consequence.

It is understandable that people living and working in a disaster zone would not have a detailed understanding of the effects of different radioisotopes or the radiation they produce. However, it is shocking how few of Alexievich’s witnesses seem to understand the difference between radioactive substances and radiation, the need to avoid contamination, or the way in which hazardous materials might enter the food chain. But the authorities seem to have blundered about, ripping the soil from one farmer’s fields while leaving the next-door land untouched, and burying dead livestock under just a few centimetres of soil.

After reading 200 pages of this testimony, it is something of a relief to come across the words of Vasily Nesterenko, former director of the Belarusian Institute for Nuclear Energy. He understood how the cloud of radioactive material was moving, how it would precipitate out, and the need for iodine prophylaxis. However, the local people continued with their everyday activities, saying that the authorities had issued no warnings, and the authorities themselves accused him of scaremongering. When he was eventually admitted to meet the General Secretary of the Belarus Communist Party, the reply was that there was no need to disturb Moscow, this was a Belarusian problem that could be dealt with by
the Belarusian people. Nesterenko wonders how many lives that vainglorious response cost.

Today, hundreds of thousands of evacuee families are scattered across the former Soviet Union. Their children are shunned by their schoolmates. Their proposals of marriage are rejected. They live with depression and memories of happy lives in the years before 1986.

For me, the important message of Alexievich’s report is this: the Soviet Union understood how to deal with a nuclear explosion and was well-equipped to do so. However, when the crunch came in April 1986, the human systems required to implement this understanding failed. The Fukushima incident in Japan seems to have been different, perhaps because the tsunami which caused it was such a vivid display of the power of nature. Radioactive materials and the radiation they emit are largely invisible hazards whose effects, both physical and psychological, can take decades to appear.

David Sang

**WE RECOMMEND**

**Voices from Chernobyl: The Oral History of a Nuclear Disaster**

Svetlana Alexievich, translated by Keith Gessen

**Rating:** ★★★★

**Price:** £10.99

**Details:** Published in 2006 by Picador (originally published in Russian in 1997).


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**BOOK: FROM THE GREAT WALL TO THE GREAT COLLIDER**

**A great challenge**

Steve Nadis is an American science journalist and Shing-Tung Yau is a professor of mathematics and professor of physics at Harvard University. Their book reads like a prospectus for a new business venture. It argues the case for building two hugely expensive new particle colliders, about 300 km east of Beijing, China. First would be a 240 GeV Circular Electron-Positron Collider (CEPC) constructed in a tunnel up to 100 km in circumference. This would later be upgraded to a 100 TeV Super Proton–Proton Collider (SPPC), in the same tunnel.

In the Preface, Yau states that ‘China has some catching up to do—and, fact, a lot of catching up to do. …This accelerator venture … goes to the heart of what the term ‘civilisation’ is all about. Simply put, human societies need to keep exploring in all kinds of directions—geographic, scientific and artistic—in order to stay healthy and stay relevant.’ The book’s Introduction is titled ‘A Clarion Call’.

Chapter 1 reviews the development of particle physics during its first century, starting with J J Thomson’s discovery of the electron in 1897 and finishing with the standard model of quarks and leptons, revealed by high energy colliders. Chapter 2 discusses the Higgs particle, from hypothetical boson in the 1960s to the announcement of its discovery at CERN in June 2012 and Nobel prizes awarded in 2013.
Chapter 3 describes weaknesses of the standard model and a need to go beyond it. These include incorporating the laws of gravity (general relativity), neutrinos having mass, the mystery of ‘dark matter’ and unanswered questions about the Higgs particle. The chapter goes on to explain supersymmetry and other possible ways forward for testable theory. A proton collider that attains energies higher than the LHC’s 14 TeV would aid in the search for supersymmetric particles. However, proton colliders (e.g. the LHC) produce a messy spray of debris, because protons are composite particles made up of quarks and gluons. Colliding electrons and positrons can give a much cleaner Higgs signal, because they are fundamental particles.

Chapter 4 describes how, in recent decades, Chinese research facilities and physicists, at home and abroad, have contributed to particle physics and cosmology—particularly neutrino physics. Most important has been the amassing of the human capital necessary for world-class research in China, i.e. an academic structure linking thousands of people with mathematical, scientific or technical expertise. International cooperation is another important dimension. For example, the authors write that ‘about 350 physicists from some 50 institutions and eleven countries work at the Institute of High Energy Physics’, in Beijing.

Chapter 5 discusses in detail the collider which might be built by China as the leading nation in a new international collaboration. Also, in little more than two pages, four other possible successor colliders to the LHC are described. Foremost among these is the 31 km long International Linear Collider which, as I write this review in December 2015, Japan may host. The other contenders are a Compact Linear Collider, at CERN; a Very Large Hadron Collider, at Fermilab; and a Future Circular Collider (circumference 80–100 km), near Geneva. All five of these colliders are at some stage of planning. Each may take more than a decade to construct. It is questionable whether any of them will be funded while national and global economies remain weak. Chapter 6 describes potential spin-offs and benefits of a new Chinese collider to China and the world at large.

An oddity of the book’s style is its frequent quoting of analogies used by other scientists when explaining particle physics concepts to a general audience. As a result, in the index there are at least five entries, in some cases many more, for each of the following scientists: Nima Arkani-Hamed, John Ellis, Fred Harris, Joseph Incandela, Ashutosh Korwal, Luciano Maiani, Michael Peskin, Matt Strassler, Gerard ‘t Hooft, Samuel Ting, Yifang Wang and Chen Ning Yang. So frequently do the authors quote other scientists that wasps came to mind, with their re-processing of wood to make paper nests.

Since mid-2015 China has been arresting or detaining some of its human rights lawyers and legal assistants, with twelve reportedly still in detention in January 2016. China is clearly struggling to reconcile a commitment to legal rights with government from the top. Science flourishes in an open society. Particle collider collaborations involve many thousands of scientists and engineers from across the world freely communicating, with lots of international travel. However well-written the prospectus for a new collider in China, and however much support the proposal gains from leading physicists around the world, can anyone confidently predict how well China, over several decades, might manage its construction and operation?

Peter Campbell
Science fiction is a genre which you probably either like or avoid, with nothing in between. For all those who love it and who have sometimes wondered whether ways of travel through wormholes, twin paradox situations or evaporating black holes are pure speculation and fantasy or scientifically possible, this book is a must.

In 4 main sections with a total of 21 chapters Adler discusses, from a physics-oriented point of view, a huge number of different phenomena in fantasy (e.g. Harry Potter) and science fiction novels. Are even extremely large numbers of candles sufficient to illuminate the great hall in Hogwarts? What kind of energy considerations might apply to the teleportation of objects? What kind of space travel is reasonable, what are consequences for the space traveller and is faster than light travel possible? What about aliens and other lifeforms in the universe? And finally, how will civilization end if we survive our short-term severe problems of global warming, ice ages or asteroid impacts? Could we move our whole planet away from our future, dying Sun?

Adler touches on almost every imaginable science question related to science fiction and fantasy stories. Based on the conservation laws of physics, the theories of relativity and our current understanding of cosmology, he places them in several categories. Some ideas or phenomena described in stories are realistic, in the sense of acting according to fundamental natural laws of the universe as we understand them now. Others are ideas that may or may not work. Finally some are pure speculation, obviously violating physical laws.

There are just a few flaws in the book:

1. The author uses the word ‘light’ to describe all kinds of electromagnetic radiation. This is not only unusual but also misleading. Light should only refer to the visible range and all other EM waves should be described as radiation, e.g. UV radiation or IR radiation.

2. A fundamental confusion may arise from his description of the second law of thermodynamics. The 2nd law thermodynamics does not mean ‘that you have to do work in order to make heat flow from an object at higher temperature to one at lower temperature’. This error slid through twice (pages 21 and 66) though his discussion in adjacent parts of the text is consistent with a correct interpretation.

3. I believe that in the 21st century, even popular books should use SI units. There should be no kcal but only joules and there should be no pressures in mb but only in Pa or maybe hPa.

4. Finally, one error occurs repeatedly when describing the composition of the earth’s atmosphere. It is not 74% N₂ and 24% O₂ but rather 78% N₂ and 21% O₂. Also, since the book was published in 2014, the CO₂ concentration should be given as 400 ppm instead of 380 ppm.

These critical remarks, however, do in no way reduce the pleasure of reading this book. Of course, the author had favourite science fiction novels and they are not necessarily the favourite ones of everyone, let alone this reviewer. Personally, I would have liked to see more reference to the Rama series of books from Arthur
Many loggers that have been produced over the last 10 years have relied on the availability of a computer or most recently a tablet or mobile to provide the analysis engine once the data has been acquired. The Vision logger bucks this trend by having a fully self contained logger with graphical and analysis functions built in.

The logger is approximately 15 cm by 10 cm in size. It has a 5 cm \times 10 \text{cm} colour touch screen and comes with a small, but useful stylus. Once the unit has been charged and turned on you are met with a fully fledged graphics interface. The menu choices are sufficient for most levels of usage. Options available are logging, meter, snapshot, programmable logging, timing and oscilloscope. On top of this there are buttons to allow access to stored data, a cable link to a computer and an apps section containing the WiFi app that allows the unit to act as a WiFi transmitter.

Choosing the ‘Easylog’ option leads to a plug and play logger which auto scales as it logs. This for basic logging is fine. If more detailed logging is required then the Graph option allows a number of parameters to be specified; including the total time and the time between samples as well as a triggering level. Once data has been acquired then there is no need for attaching to a computer. All the data analysis functions are available on the logger.
The range of analysis tools is very impressive and allows the logger to be self-contained; no need to have a computer nearby to continue the experiment. Constructing a simple distance time graph using a distance sensor allowed the gradients to be calculated and velocity and acceleration graphs to be constructed. Other calculations are simple to perform; logging voltage and current for a cell allowed a graph of power versus load resistance to be calculated with ease. The scaling functions made displaying the data very easy. Using the logger as a timer with light gates was equally as easy. The timing function allows light gates to be used in dynamics experiments such as force and acceleration at different loads. Saving the data is straightforward, as is taking screen grabs. What is really surprising is how much can be done on the logger itself including saving and recovering data using a GUI interface.

Once connected via a cable to a computer, tethered logging is enabled, although I found very few advantages of having a tethered connection. The computer software (Windows) allows a similar range of analysis to that found on the logger. The layout was similar and had the same menu structure; this is a great advantage in that one menu system has to be learned. The review model is WiFi enabled and so is able to be tethered via a WiFi link; this is enabled via an ‘app’. Using the iPad software is not as intuitive as either the PC or logger software. The layout is different and the range of what can be done seemed limited, although I am assured that the software is to be updated in the very near future. However this does allow tethered logging to take place and for the data to be analysed and sent to other applications. I was disappointed to find that an X-Y graph was beyond my ability to achieve if time was not on the X axis and that a CSV export, failed on two occasions sending zero data to ‘notes’, ‘numbers’ and Google Drive.

The iPad software should not be something that puts any potential purchaser off buying this logger. The software (version 1.0.7) can be updated, it is the logger itself, which is the key; it is very easy to use and at £299 for the basic logger or £349 for the Wi-Fi enabled unit, is very cost effective. The learning curve is very shallow; without the use of a manual I was able to log,
manipulate and analyse data in less than 30 min, even the most complex tasks are easy to carry out. A typical school student should be able to pick this up very quickly. The similarity of the PC and screen software makes this a joy to use. There is a wide range of sensors (see link below), which cover almost all the scenarios that I could imagine wishing to log. The sensors are easy to use and are recognised by the logger immediately. The logger can accept up to four sensors or two timing gates.

The logger has a variety of outputs; two USB connectors, Wi-Fi and a video out to connect to a monitor. Free software is available for PC/OSX and iPad.

Alongside the logger, once paired with the Dynamics system (see separate review), you have a very powerful system for teaching a wide range of Physics.

Data Harvest have now provided an Android version of this software, which was not available at the time of the review. If, as hoped, that it and the accompanying iPad software are of a similar quality to the software available on the logger itself, then they will have a formidable piece of classroom equipment.

John Kinchin

We Recommend

Vision Data Logger
Data Harvest
Rating: ★★★★/★ (4.8/5)
Price: From £299 for the basic logger or £349 for the Wi-Fi enabled unit.

Equipment: Data Harvest Dynamics System

Making dynamics experiments easy

Designed to be used with the Data Harvest SmartQ sensor system, the Dynamics System is best described as a construction kit for Physics teachers. At the heart of the system is a vertical tower with a twin track ramp. The design of the system is very clever in that there are three rebated slots capable of taking a machined bolt, which allows the ramp to be held in almost any position possible. Various add-ons can also use this or the other slots. Among the add-ons are a number of plastic ‘L’ shaped mouldings, with their own slots. These can be bolted onto the
ramp to hold all manner of sensors or add-ons. Also supplied with the kit is a small model car. This has very low friction wheels, which fit into two rebated tracks on the top of the ramp. The car is also well designed; slots on the front can hold a plastic reflector shield, whilst the top has a screw-threaded hole to hold a mass holder or a threaded nut to which string can be attached. Sensors such as distance, force, rotation and light gates are easily fixed to the system ramp. A pulley can also be attached; especially as it has spokes so can be used with the light gates to measure motion.

Setting up the system was initially not clear; reading the manual helped greatly! Because of the adaptability of the system, you can attach almost anything anywhere and this is a real strength, but can also lead you down the wrong avenue very easily. This is not the fault of the apparatus, more the enthusiasm over common sense of the reviewer!

Once you have a feel for how things fit together, then the system is a joy to use. The heavy stand keeps everything stable, though a clamp stand was needed at one point. Pretty much any dynamics experiment is possible, using the extension kit allows investigations into momentum, equations of motion, Newton’s laws, kinetic and potential energy and crumple zones, however the basic kit allows a wide range of experiments to be carried out. The work on crumple zones was very easy and made this investigation much simpler than I had found before.

The dynamics system is best served using the SmartQ sensors, however this is not an absolute necessity. I found that using light gates and distance sensors from other retailers also worked. This is an advantage for those schools who have already invested heavily in data logging equipment. However it must be stressed that using the Data Harvest sensors was much easier, simply
because the Dynamics System is designed to accompany the sensors, which have mounting holes and brackets to fit onto the ramp.

One of the real joys was being able to carry out experiments that I had not been able to carry out before with any real success. The shear adaptability of the ramp made it very flexible and very easy to adapt to my needs. I did need at one point to use a clamp stand to help in one experiment, a hexagon nut onto a clamp stand boss would have been useful, as it was, a small length of steel tube with a bolt fitted to it made a suitable substitute.

The system is much more preferable to wooden ramps and a plethora of clamp stands. The SmartQ sensor system integrated very well and after a very short learning curve I was away and actually enjoying trying out combinations that were not in the excellent manual, which is a downloadable PDF from the Data Harvest website.

The Dynamics System is not cheap, however it really does make dynamics experiments easy to carry out with impressive results. The dynamics extension kit is very useful, but not 100% essential; at just over £220 the entire system is worth the outlay, even if you only buy one for A Level investigations. This is an ideal replacement for the typical school air-track and is much quieter!

John Kinchin

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