

Bristol pays tribute to John Ziman

John Michael Ziman FRS
1925–2005

Physicist, philosopher, humanist who explored the meaning of science in society “Science is public knowledge” Lived here from 1964 to 1982

This was the wording that was composed with Christopher Orlik, the local council’s “Mr blue plaque”, for the plaque to be installed outside the house in which John Ziman lived in Westbury on Trym. Although John and I never worked together, he was the closest anyone came to being my mentor, so, when his daughters Kate and Claire invited me to speak at the unveiling of the plaque on 17 March, I agreed.

I knew that the Lord Mayor of Bristol would be present for the unveiling, as would John’s widow, Joan Solomon. The head of Red Maids School, where the daughter of the present occupants of the house is a pupil, had asked me if

some of her girls could attend the event. What I did not know until the night before was that they were not seniors, as I had assumed, but infants and juniors, and that “some” meant the entire school. So I hastily rewrote my speech and awaited the event with apprehension bordering on panic, because John Ziman was a deeply intellectual man, not someone whose work could easily be summarised for five-year-olds.

Arriving at the house on a chilly morning, I was greeted by 107 little girls on the pavement opposite. They were as good as gold and politely listened, or at least pretended to listen, as I gave my speech.

Then Joan Solomon stepped forward to give her prepared speech about John’s last book, *Science in Civic Society*, which she had arranged to be published posthumously. But when she saw all of the girls, she instantly reverted to her physics teacher mode of many

years ago – an inspiring teacher according to Julie Staunton, one of her star pupils who studied for her BSc and PhD in Bristol and is now a professor at the University of Warwick. Fixing the girls with what I can only describe as a commanding twinkle, she began: “Good morning girls”.

The voices of 107 girls in high-pitched unison replied: “Good morning”.

“Cold, isn’t it?”

“Yes”.

“Then let’s jump up and down, shall we?”

Obediently, everyone (including the adults) jumped.

“Are we warm now?”

“Yes”.

“Well, that’s physics! Now you know that science can be useful.”

The Lord Mayor unveiled the plaque and the present occupants of the stunningly remodelled house invited us to have refreshments.

Michael Berry

Neutrons star in the South West

In the first branch lecture of the new academic year, organised with the IET, Dr Anna Watts of the University of Amsterdam spoke at the University of Gloucestershire on “Firestorms and starquakes: the dangerous life of a neutron star”.

The talk’s abstract conveyed some of the excitement:

“On 26 December 2004, an earthquake off the western coast of Sumatra triggered a deadly tsunami. The tremor was so violent that it left the Earth ringing for days, enabling seismologists to study the interior of our planet. Less than 48 hours later, the Earth was hit by the brightest burst of gamma rays ever recorded. The cause? A starquake on a neutron star with an ultra-intense magnetic field, 50 000 light-years from our solar system. And just as on the Earth, the quake left the star ringing with seismic vibrations – the first time that this had ever been observed.

“This has opened up a new way of studying these stars, with their crushing gravity, exotic nuclear physics and enormous magnetic fields. I will discuss what we are learning from neutron starquakes, triggered by everything from magnetic flares to thermonuclear explosions, and outline what we hope to discover with future observations using both electromagnetic and gravitational wave astronomy.”

Branch secretary Dr Edward Ratzer attended the talk and sent the following report.

“In a well illustrated talk, Dr Watts presented the current state of knowledge on neutron stars as well as some of the more speculative theoretical ideas that will be able to be tested by future generations of gravitational-wave detectors. Furthermore, she linked the techniques and findings back to Earth geophysics and in particular the study of earthquakes. This was a very strong start to the season of lectures and a good precursor to further astronomy talks.”

Roger Brewis, editor

South West lecture programme

At the time this newsletter goes to press, the branch lecture programme is as follows. It starts strongly with a cosmology series that kicked off with a bang, literally in Cheltenham in September and continues with another in Bristol.

5 November 7.30 p.m.

Is the Big Bang in big trouble?

Gary Mathlin (Bath University) Junior Common Room, Bristol Grammar School, Bristol.

12 November 7.30 p.m.

Twinkle twinkle little neutron star

Paul Roche (Cardiff University) Junior Common Room, Bristol Grammar School, Bristol.

26 November 7.30 p.m.

The cosmic web

Peter Coles (Cardiff University) Junior Common Room, Bristol Grammar School, Bristol.

4 December 7.30 p.m.

(refreshments from 7.00 p.m.)

Fusion: powering the world’s future

Tim Jones (JET) Elwes Building, Park Campus, University of Gloucestershire, Cheltenham.

The physics principles and latest developments in magnetic fusion will be discussed, together with technological and key engineering challenges that need to be overcome to make fusion energy a reality.

5 February 2009 7.30 p.m.

(refreshments from 7.00 p.m.)

Ambrose Fleming

Dr Brian Bowers Elwes Building, Park Campus, University of Gloucestershire, Cheltenham.

Ambrose Fleming is remembered primarily for his invention of the thermionic

valve in 1904 – the invention that made radio practical. But that was only one of the contributions that Fleming made to electrical engineering and to modern life. The valve arose from his work as scientific adviser to the Marconi Company. He was also closely involved with the early electric-lighting industry.

21 March 2009, all day

Festival of Physics (includes branch AGM)

Redland Green School, Redland Court Road, Redland, Bristol.

These are always entertaining and informative days, with good food and good conversation. A full report on the 2007 Festival of Physics was included in the June newsletter and can be viewed on the branch website at www.iop.org/activity/branches/South_West/index.html.

Check out the branch website at <http://sw.iop.org>

Speech relives Ziman's physics

This is Prof. Michael Berry's speech at the unveiling of a blue plaque in celebration of John Michael Ziman.

"We are here to celebrate the life of John Michael Ziman, who came to Bristol from Cambridge in 1964, aged 39, and lived in this house for 18 years. His daughters wanted this fine plaque to be installed; the new owners of the house, Mr and Mrs McAndrew, have graciously agreed; and Christopher Orlik from the council has made all of the arrangements for today's unveiling. This included asking me to speak about John, and inviting his widow, Joan Solomon, our Lord Mayor and girls from Red Maids School.

"John was a physicist whose career followed an unusual pattern. I'll say why it was unusual after telling you about his physics.

"Most people who are not scientists think that physicists spend their lives trying to discover the fundamental laws of the universe. Some do, but this search is rewarded only rarely – less than once in a century. That's because we already know the laws that describe the physical world on our human scale, on vast cosmic scales, and on the tiny scales of atoms and smaller. What's left is understanding how these laws of nature in the large and small fit together; at the moment, they don't.

"But the physics that we already have is wiser than we are; hidden in its mathematics are explanations of many things that are important in our everyday lives and in our technology, and it can take a lifetime to understand just one small area. This is how almost all scientists spend their lives, including John Ziman.

"His special area was the physics of metals. There's a great deal to understand: why electricity passes better through some than others; why some are magnetic and others not; why some are hard, some soft and some brittle; why they are all different colours; and why some melt at low temperatures while others

stay solid up to thousands of degrees.

"Metals are made of atoms, with electrons moving among them. Electrons and atoms are tiny, and the physics needed to describe them is quantum mechanics. This is weirdly different from the earthly and astronomical scales described by Newton's physics, with its forces (gravity, friction, etc).

"Quantum physics is deeply mathematical. That's why physicists tend to divide into theorists, who do the mathematics and try to come up with explanations, and experimenters, who test the explanations in the lab and often discover things that theorists didn't think of. John Ziman was a theorist, but one who kept very close to experiments. He was never happy unless he could calculate a number that agreed with what experimenters had measured.

"There's an earlier Bristol connection. In the 1930s, long before John came to Bristol and soon after quantum mechanics had been developed, the theorist in our department – Nevill Mott, who later received the Nobel Prize – was among the first to realise that this new physics would be important in understanding metals, and he attracted sponsorship from industry. In those days, this was unusual.

"John started (in Cambridge, and Oxford before that) by studying the magnetism of metals, but soon moved to the area that made him famous. This was metals in their liquid form. These are important not only to understand but practically – in nuclear reactors, for example, liquid metals are used to conduct the heat away from the reacting core and to cool it. They are hard to study because they are different from solid metals. Solids are crystals, with the atoms arranged regularly like oranges packed neatly in a box. In liquids, the atoms move around randomly. So to understand liquid metals you must understand the quantum physics of electrons among a

disorder of atoms.

"When John entered this fiendishly difficult area, there were no formulae describing the amount of electricity that would flow through a liquid metal. He had the persistence and insight to cut through the complications and make predictions that agreed well with what was being measured in the lab.

"Another Bristol connection is that the ideas that John applied with such imagination and so precisely were based on a general formula devised by Derek Greenwood, who was a member of this department until he died a few months ago.

"These ideas apply more widely. When metals are mixed to form alloys, even solid ones, these are crystals too but with different atoms randomly on the different sites. Since quantum mechanics describes matter in terms of waves, the ideas that John developed apply to other types of waves too, such as explaining why light bouncing among water drops in clouds makes them white, or why the lenses inside our eyes are transparent even though light gets disturbed by irregularities inside them. In physics, once something has been discovered in one area, the ideas get applied all over the place, even in subjects that seem different but where at a deep level the same principles are at work.

"If this were all, we would still be celebrating John Ziman today, as a high-class successful theoretical physicist. But, as I said, there was another side to him: he was a deeply cultured man. To be cultured means not just to be good at one thing all your life, whether it is physics, maths, music, sport, politics or anything else. It means being interested in the connections between different aspects of life. For John, this meant not only doing science – making physics – but understanding how and why science works. This is usually studied as philosophy, concerned with logical mysteries like how it can be that we scribble weird

mathematical symbols on paper and this can describe what happens inside a star or be applied to design the thousands of transistors in your mobile phone.

"But as with his physics, John's way of thinking was unusual even here. He realised that science is not just logic; it is also a human activity. It succeeds because minds working together reach farther and deeper than minds working alone. On the surface there is some occasional competition among scientists, but it is an overwhelmingly co-operative activity. The lone scientist is a romantic myth.

"From his earliest years as a scientist, John was concerned with this aspect: how the community of scientists organises itself. He wrote several books on this theme while in Bristol. But – and this is the unusual part of his career that I mentioned at the beginning – suddenly, a few years before he left Bristol in 1982, he abandoned physics completely and devoted the rest of his life, in London and then near Oxford after he retired, to exploring how (in his words) science is social. That is why on this plaque you will read (and it is another of his phrases): 'science is public knowledge'.

"Last but certainly not least, I will mention another of John's lasting achievements: he created the modern theoretical physics group within the physics department in Bristol. Soon after he came here, he encouraged a number of young physicists to join him – including Robert Evans, now the head of the physics department, who is here today, and me. It is not easy to keep people working in different areas feeling that they are part of the same group. One way in which John did this, and one that we remember with affection, is through the relaxed and magnificent summer parties offered by him and his first wife Rosemary in this house and in its garden that he loved so much.

Michael Berry