

Castle Eden Planetarium

Newsletter 4

Incorporating

Transit

(The magazine of the Cleveland and
Darlington Astronomical Society)

May, 2001

Located on the Nature Walkway near Thorpe Thewles, Stockton-on-Tees, and jointly founded in 2000 by the Cleveland and Darlington Astronomical Society and Stockton Borough Council, to bring the universe to everyone.

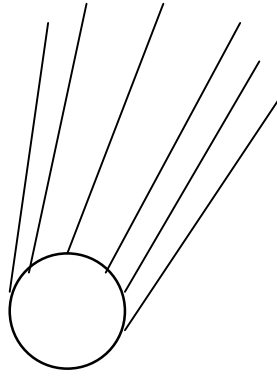
Editorial

From Alex Menarry (CaDAS)

Dr Adrian Jenkins presented his lecture last month. An object lesson in professional presentation, with a mixture of overheads, slides and computer projection. The subject matter can fairly be described as "large scale". What could be more difficult as a research subject than modelling the basic structures of the Universe? The aim is to arrive at a viable theory for galaxy formation and the way in which galaxies have grouped themselves. Fortunately, the lecturer pitched the technical level somewhere within our reach. The mathematics of these models must be . . . er . . . well . . . I wish I could think of a word.

The last month has seen some spectacular aurora displays in various parts of the country. The views from this part of the World are reported inside. My family in Scotland were overawed by the displays seen from a dark sky site near Oban. In May, the lecture on the 11th is "CCD Astronomy" by our own Chris Walker and John McCue.

Please support this newsletter as an excellent means of communication between members by sending something for publication. Your views on the planetarium developments, what you have been up to recently, an astronomy holiday you have planned, any good contacts or web sites you have come across. Castle



Eden Planetarium Newsletter needs your support. (see contact addresses at the end of the Newsletter).

Latest news

Building work continues on the planetarium. The training scheme, which has provided valuable bricklaying skills for young people as well getting our new astronomical facility under way, is drawing to a close. Ron Peacock is now supervising work by skilled tradesmen on the roof; rafters are in place and it should not be too long before our own society volunteers will be able to get to grips with interior work. Exciting times are ahead! Ron is also looking at the possibility of a design which will facilitate a slight tilt to the actual planetarium dome. It will be suspended from the interior of the roof, and supported by an ingenious system of air pressure of which Ray Worthy has experience, having built one for a planetarium in Helsinki. A tilting dome is a modern trend allowing for more comfortable viewing and flexible operation.

The trench connecting the planetarium to the observatory is continuing; a conduit will be laid carrying wires for electronic signals. The wonders of the universe will be brought live to planetarium audiences! Our society member Dr. Ed Restall has just helped John McCue network his own home observatory computer to his indoor computer. It has given them valuable experience and Ed has pledged to supervise the networking of the planetarium and the observatory.



The planetarium will use an A1 Spitz planetarium projector, the first model made by the renowned American company. They are now up to model A5, an example of which has just been bought by Jodrell Bank at a cost of a quarter million pounds! The A1 has been granted free of charge to our project on condition that it is fully and properly used, by

the Genk planetarium in Belgium where it was used for many years before being superceded.

The observatory has been successfully sealed against rain leakage, and plans are underway to enhance its optical capabilities. By a coincidence, the society has been offered at this time a 19-inch mirror, fully figured and polished, at a very reasonable price. This has now been coated by Sinden Optical Company, and is currently undergoing testing. We are looking at ways of incorporating this into the observatory while retaining the extant 8-inch refractor, a fine planetary and lunar instrument. Whatever happens, fundraising may well be on the cards for the astronomical society!

The Aurora of Wednesday 11 April 2001.

from Charles Rees, FRAS (CaDAS)

After leaving a tutorial on Wednesday evening around 8:30pm, I noticed the sky was unusually bright for this time of year, but thought nothing of it at the time. It was not until around 10:00pm that I received a phone call from David Weldrake that there was an Aurora taking place and that it was going to increase in brightness later on in the night. I quickly went outside and saw a faint red patch of light towards the East out of the way of the light polluted area of the sky, it was then that I had to get my camera to try and catch this phenomenon on to film, this patch of red light gradually faded after a short time.

I turned my attention to the Western side of the sky and noticed streamers of bluish/white light streaking across the sky and attempted to take photos of that part of the sky. I had to return to my studies and when back out around 12:30 am on the Thursday morning the clouds had rolled in but through the breaks in the clouds I could quite distinctly see the streaks of bluish/white light, then around 1:10am there was a bright white streak arcing round from the zenith towards where the sun would be in the southern hemisphere.

At 1:15 am the aurora was over as the Moon had climbed above the cloud cover causing its light to overpower the light from the aurora.

As observed from Ripon, N.Yorks

from David Graham (CaDAS)

The local BBC evening news weather forecast gave indication of a possible auroral display

following receipt of a report from the University of York of a disturbance to the Earth's magnetic field.

Looking out a 20h 30m UT in a largely clear sky, an amorphous glow was noticed to fill the northern sky, from due east to west, with a 'strengthened area' above the western horizon (though this may have been noticed because the sky in that area is more accessible than that to the east at this site) and a suspected arc along the northern horizon, despite sodium street lighting providing an artificial sky-glow to the north.

At 22h UT confirmation that this was an aurora was provided in the form of definite auroral rays filling the circumference of the northern sky, from due west, through north, but perhaps not fully reaching due east. At this point the rays stretched as far north as the bowl of Ursa Major and took on a distinct red colour. By now the strongest rays had reached the zenith and a corona formed just to the north of the sickle of Leo appearing as a stubby bar but this was short lived.

The rays began to die back by 22h 20m UT and I continued to watch until 23h 40m UT by which time a glow remained in the northern sky but with no ray structure. Households contacted giving notice of the aurora were Chris Walker, Jack Youdale, John McCue, John Rogers and Ron Livesey.

The Big Freeze

from Neil Haggath (CaDAS sec.)

(The April Newsletter could only carry an abridged version of Neil's article. With apologies for the delay, here is the full article: Editor)

This article is based upon the BBC2 'Horizon' programme, shown on 22 February, entitled "Snowball Earth". Though mainly concerned with geology and climatology, it's also rather interesting to us astronomers.

We all know that, several times in its history, the Earth has suffered "ice ages", during which severe global climate changes caused the polar ice caps and glaciers to expand into normally temperate regions. No-one knows for certain what caused them; one possibility is fluctuations in the energy output of the Sun.

But imagine the prospect of a global "super ice age", one so severe that the entire planet was entombed in ice, up to a kilometre thick, for ten million years! Incredible though that

may seem, some geologists believe that, 600 million years ago, that is exactly what happened. The controversial theory has been around for over 50 years, but 99% of geologists have always dismissed it as absurd – until recently.

Conventional wisdom always dictated that, no matter how severe an ice age may have been, there would always be one region of the Earth which remained safe and warm – the tropics. As we know, the tropical region receives the maximum intensity of solar heating; even if the Sun were to cool to its lowest imaginable temperature, the tropics would still receive sufficient heat to halt the advance of the ice. Indeed, we know, from geological evidence, that the tropics *did* remain comfortably warm during the known ice ages.

For decades, this was assumed to be a fundamental law of nature; the tropics could never freeze. But in numerous locations around the world, there exist geological formations which the conventional laws of nature can't explain.

One such site, beloved by supporters of the super ice age, is found in Namibia in southern Africa. A scorching desert, only 20° south of the Equator, is an unlikely place to find evidence of glaciation – but that's exactly what's there! There is a layer of sedimentary rock, 600 million years old, which indicates that the region once formed a seabed. Embedded within the layer are large boulders of harder rock. These are known as “drop stones”, and can only be produced by one known process – a glacier.

As a glacier carves its way through the landscape, it carries boulders and other debris along with it. When it reaches the coast, blocks of ice break off from its end and topple into the sea; as the ice melts, the embedded rocks fall to the seabed. Over millennia, as the sediment builds up, the boulders become embedded in it.

The super ice age was first proposed in the 1940's by Cambridge geologist Brian Harland. He had extensively studied glaciers in the Arctic, and learned to easily recognise drop stones and other telltale signs in the rock strata. He later analysed rocks from all over the world, and made an amazing discovery. On every continent, including numerous locations in the tropics, evidence of glaciation was found, and always in rocks of the same age – 600 million years.

All the evidence suggested that, at that time, an ice age of unimaginable intensity had spread across the entire planet, all the way to the Equator. But most geologists insisted that it was impossible, and that there must be some other explanation. During the '50's, as the concept of continental drift became

respectable, many thought that that would provide the answer. They argued that, 600 million years ago, all the continents must have been clustered at higher latitudes, with no major land masses in the tropics. Then a mere “conventional” ice age would have been enough to account for the observed signs of glaciation.

That idea was widely accepted until the late '70's, when Joseph Kirschvink, of the California Institute of Technology, threw a huge spanner in the works. At many of the tropical drop stone sites, he used the magnetic alignment of the rocks to show that the drop stones had indeed been formed close to their present latitudes, and not carried there from colder regions. Until that time, Kirschvink had thought the idea of global glaciation was mad, but he became converted, and is now one of the theory's most ardent supporters.

Meanwhile, the long-held belief that the tropics could not possibly freeze had been challenged. During the '60's, at the height of the Cold War, scientists had been investigating the possible consequences of a global nuclear war, and had proposed the now familiar concept of “Nuclear Winter”. It was realised that this phenomenon could create, in effect, a man-made ice age. A Russian climatologist, Mikhail Budyko, attempted to calculate how severe this ice age could be – and his conclusions were frightening!

Budyko found that the “law of nature” regarding the freezing of the tropics was unfounded, since the geologists had overlooked something rather important. Ice is, of course, highly reflective; as an ice age advanced, the increased albedo, or reflectivity, of the frozen regions would result in considerably less solar energy being absorbed, and so those regions would become ever colder. Even after the debris had settled out of the atmosphere, and normal solar heating was restored, this effect would mean that the ice would continue to advance.

During the known ice ages, the ice advanced to about the latitude of New York. Budyko calculated that if, during an exceptionally ferocious ice age, the ice reached a certain critical latitude – about that of Texas – then it would become unstoppable. The huge temperature gradient between the tropics and the frozen regions would result in more and more of the heat absorbed in the tropics being carried away by convection currents, to the point where even the Equator could not retain enough warmth to halt the freeze. The entire planet would indeed become encased in ice, with temperatures, even in the tropics, plummeting to around -40°C.

Though Budyko was concerned with the effects of nuclear war, we now know of a natural event with almost identical consequences. During the '70's, Luis Alvarez proposed that an asteroid impact, with its Nuclear-Winter-like aftermath, was responsible for the Cretaceous-Tertiary mass extinction event, which wiped out not only the dinosaurs, but 70% of all the living species on the planet. At the time, this idea was also ridiculed; today, it's widely accepted as almost indisputable. So it's quite feasible that another asteroid impact, several times bigger than the K-T event, could have triggered the super ice age.

There was, however, a major snag. While Budyko's calculations showed that the global freeze was theoretically possible, they also showed that it could never have happened in reality, because if it ever did, it would be permanent and irreversible. The vastly increased albedo of an ice-covered Earth would mean that it could *never again* absorb enough solar heat to melt the ice. The planet would remain frozen for eternity – or at least until the Sun became a red giant!

This became the conventional wisdom for the next 20 years; yes, it *could* happen in theory, but it obviously never *has* happened. To make the super ice age plausible, its supporters needed to find a way in which the Earth could escape from it; it wasn't until the late '80's that Kirschvink found the answer.

No matter what happens on the surface of the Earth, its deep interior always remains hot – over 1000°C, in fact. And some of that heat escapes to the surface through volcanoes. Geologists had long since concluded that, while volcanic activity would cause small-scale local melting of the ice, the combined heat of all the world's volcanoes would be orders of magnitude less than that required to significantly increase the global temperature and reverse the freeze.

But Kirschvink realised that something else had been overlooked. As well as hot magma, volcanoes emit gases. In particular, they emit huge quantities of carbon dioxide into the atmosphere – some ten billion tons of it per year, worldwide. And CO₂ is responsible for something with which we are now all familiar – the Greenhouse Effect and global warming. (At the time of Budyko's work, this was unheard of; it wasn't discovered until the late '70's, as a result of spacecraft studies of the atmosphere of Venus.)

So during the super ice age, volcanoes which melted channels through the ice would release vast quantities of CO₂ into the atmosphere. Normally, this excess CO₂ is dissolved in rain and flushed back out, so the amount of it in the atmosphere remains stable. But in an era in

which the entire surface of the Earth was frozen solid, there would *be* no rain! So with nothing to cleanse the atmosphere, its CO₂ content would rise inexorably; Kirschvink calculated that after ten million years, the atmosphere would contain around 10% CO₂ (compared with a fraction of one percent today). The result would be a runaway greenhouse effect, which would not only heat the Earth enough to melt the ice, but would raise the average global temperature to around 50°C. The coldest period in the Earth's history would be rapidly followed (in geological terms) by the hottest!

So Kirschvink had shown that the super ice age could indeed have happened, *and* could have been reversed. What he lacked was evidence to prove it. Paul Hoffman of Harvard, another ardent supporter of the theory, found it in 1992. Hoffman had studied the tropical drop stones, particularly those in Namibia, and was puzzled by another strange feature which had baffled geologists for decades. Immediately above the drop stone layer are huge formations of crystalline calcium carbonate. These are normally produced in warm seas, yet they appear immediately on top of a glacier – showing that the climate must have changed from freezing to hot in a very short time.

Hoffman and Daniel Schrag, a geochemist, solved the puzzle by considering what would have happened during the transition period – what Schrag calls “the mother of all climate changes”. As the temperature increased beyond the point where the ice began to melt, there would be an enormous evaporation of water into the dry atmosphere. The result would be the most extreme and violent weather which the planet has ever experienced. There would be hurricanes on an unimaginable scale, but above all, there would be rain – the first for ten million years. There would be a ferocious, planet-wide rainstorm which would rage continuously for centuries.

That rain, of course, would dissolve the excess CO₂ out of the atmosphere, so the greenhouse heating would cease, and the planet's normal climate would gradually be restored. During this period, due to the dissolved CO₂, it would in fact be raining concentrated carbonic acid. This would react with calcium in the rocks to produce abundant deposits of calcium carbonate – exactly what is observed in Namibia! But wait! I hear you say. If this Big Freeze actually happened, then how could life have survived it?

600 million years ago, there was no life on the land; it was still confined to the sea, and had not yet evolved to anything more complex than blue-green algae. But much of that primitive life, including algae and cyanobacteria, depended on photosynthesis.

When Hoffman and Schrag promoted the super ice age theory during the '90's, biologists protested that it was impossible. If the oceans were covered with a thick layer of ice, then little or no sunlight could penetrate it into the water; photosynthesis could not take place, and virtually all life would have quickly become extinct. But of course, it didn't.

The answer was found in Antarctica, the coldest place on Earth. Hoffman and Schrag calculated that the ice covering the continents may have been a kilometre or more thick, but that covering the oceans would have been only a few tens of metres thick, perhaps thinning to just a few metres at the Equator. Researchers in Antarctica have found that when water freezes very slowly, as it would do at the bottom of a thick ice layer, salt and other impurities drop out of it, leaving the resultant ice exceptionally pure and clean, and as transparent as glass. There are Antarctic lakes which are covered with several metres of this pure ice, yet the water below teems with life; sunlight passes through the ice practically unimpeded. So while the super ice age probably *did* destroy most of the life which existed at the time, there could have been regions in the tropical oceans where enough sunlight penetrated the ice to enable photosynthesis, and life could have survived.

This would, in fact, have been the first of the Earth's several mass extinction events. Such an event is always followed by a period of rapid evolution, as new life forms proliferate to fill the ecological niches which have been left empty. And this is exactly what is observed in the fossil records; shortly after the Big Freeze, as the planet's climate returned to normal, we find evidence of an explosion of evolution, with the first multicellular life forms appearing, and becoming vastly more complex than anything which had lived before.

Environmental change is the greatest driving force behind evolution. Prior to the super ice age, with primitive organisms living in a benign and stable environment, evolution had occurred incredibly slowly. But then the greatest environmental disaster in the Earth's history provided the stimulus which life needed to diversify.

So the idea of the Big Freeze isn't so absurd after all. Not only does it appear to have happened, but perhaps it was even ultimately responsible for the existence of all advanced life on our planet – including us.

Dennis Tito back on earth from John McCue, on the Internet (Web-site Spaceflight Now)

Space tourist Dennis Tito was interviewed by CNN, NBC and TV 6 in Moscow.

Following are his comments about his vacation so far: "It goes well beyond anything that I would have every dreamed. Living in space is like having a different life, living in a different world. Living in zero g, viewing the Earth from above, it is so spectacular, it is so rewarding. I believe that I am extremely privileged to have had this opportunity. I think professional astronauts, maybe circulating among themselves, take this for granted. I'll tell you: there is nothing like this as an experience.

"The launch Soyuz was very smooth. There wasn't much vibration; the g-forces were not that great. I had notes of all the major staging events that occurred for the first nine minutes of flight until we were in orbit. So I was following everything very closely and I could anticipate when the engines would cut off and the new stage would fire, when the shroud was jettisoned and so forth. So I was very comfortable. I wasn't nervous at all. I don't think my heart rate was beyond 100.



"And then once we got into orbit, it was just unbelievable to see the Earth from above and the black sky. "I felt surprising well. I ended up being well for most of that -- at least half of --- the first day. And then I think I got a overconfident and I drank some juice and had some dried fruit, which didn't agree with me, so I had my first bout with space sickness and I learned that I have to be careful. From that point on, it just got better and better and better.

"My expectations originally were that things would be not that comfortable, it would be like sailing on a rough ocean. But it turns out it's very comfortable and I feel great. I have no

feeling of space sickness. My face is a little puffy because of the adaption (which) causes the blood to go to your head from the lower parts of your body.

"Everyone has been fantastic. Jim Voss and Susan Helms have just gone out of their way to show me around, give me some safety drills. They have done a great job. And of course the commander, Yuri Usachev, is someone I know quite well and he also is very friendly. It goes without saying that my Soyuz crew Yuri Baturin and Talgat Musabayev have become very close friends. So we're a good team up here.

On how his trip will affect the future of space exploration:

"If I have anything to say about it, I will do my best to communicate to different people how great of an experience this is. And how an ordinary person (can) -- one does not have to be superhuman to -- adapt to space. It is very doable. Unfortunately, it is very expensive at this point, but there are others that can afford this and I would like to encourage it. So that is what I'm going to hopefully accomplish.

Tito said he saw the American segments within about an hour after arriving at the space station on Saturday, and that the visit was "absolutely" worth the estimated \$20 million price.

On the prospect of a return trip to space:

"No. It's an experience that I want to remember for the rest of my life. I think it's everything and well beyond what I would have expected. It's time for me to help other people achieve their dreams.

"It's already helped me so far because the training experience was very rewarding. But this experience will be unsurpassed by any experience and I think it will be part of myself as person. I plan to go back to my normal life."

Dark energy

from John McCue (CaDAS), using Internet material.

There is no doubt in my mind that the most striking cosmological discovery in recent years has been that of the acceleration of the universe. Yes, acceleration! This has never even been considered as an option. The last time it was alluded to at all was when Albert

Einstein put a cosmological constant into his equations to prevent the universe contracting. At that time the expansion of the universe was unknown, and he needed a way to stop the universe gravitationally collapsing in on itself.

When Edwin Hubble found that the galaxies were rushing away from each other Einstein had to scrap his constant. He called it his greatest blunder, but he could have been right after all. It was once said that Einstein's waste paper bin contained better ideas than most of us have in a lifetime! The following material from the Internet describes the latest position on the accelerating universe.

Once upon a time, when astronomers spoke of the universe as "closed," "open," or "flat," they meant that the density of the universe was either so great that it would eventually recollapse because of gravitational attraction; or that its density was so low that gravity would be insufficient to keep it from expanding forever; or that its density was so delicately adjusted that, eventually, it would neither expand nor contract.

"Closed," "open," and "flat" actually refer to the shape, or curvature, of space-time itself. Impossible to picture in three spatial dimensions, this is easy enough in two: two-dimensional space with positive curvature would resemble the surface of a sphere (on which parallel lines converge). Two-dimensional space with negative curvature would be like the surface of a saddle or a Pringle's potato chip (on which parallel lines diverge). A flat two-dimensional universe would resemble a sheet of paper (on which parallel lines stay parallel).

Many independent observations indicate that the universe is in fact flat. Moreover, inflation theory, the notion that a small portion of the universe briefly underwent very rapid expansion shortly after the Big Bang -- which is favored by cosmologists not least because it explains a great many otherwise puzzling things, such as the remarkable smoothness and homogeneity of regions of space that have never been in contact -- requires a flat universe.

But if the universe is flat and the density of matter is low -- including visible matter, invisible matter, and ordinary energy (which is equivalent to matter) -- something must provide the missing density. That something is the cosmological constant, or some other form of dark energy.

Such invisible energy could propel even a closed universe to eternal expansion. If the cosmological constant really is constant, the expansion of the universe will accelerate indefinitely.

Researchers using the Hubble Space Telescope have announced the discovery of the most distant Type Ia supernova ever detected. The exploding star had a redshift of 1.7, implying that it happened 11 billion years ago when the universe was very young. By comparison, the previous supernova record was at redshift 1.2 (age about 10 billion years). The finding - a combined effort of three teams looking at Hubble data - has proven to astronomers that the universe is in fact accelerating.

By matching up images of the northern Hubble Deep Field with observations taken a month later, astronomers constructed a light curve for SN 1997ff and found it to be a Type Ia event. In such cases, a white dwarf explodes after it collects too much material from a companion star. Researchers then determined its distance independently of its redshift, because Type Ia supernovae are famous as "standard candles." Whenever a white dwarf explodes, it always does so in nearly the same way, with the same peak brightness. Therefore by observing how bright the explosion appears from Earth, astronomers can accurately determine its distance.

The classic analogy is to picture two light bulbs of the same wattage side by side. If one light bulb is moved 10 times as far away as the second, it will become 1/100 as bright; the brightness change tells the distance. In a very real sense, Type Ia supernovae are light bulbs with the same standard wattage. Comparing distance to redshift can tell astronomers whether the event took place when the expansion of the universe was accelerating or decelerating. Supernova 1997ff seems to have exploded in a decelerating universe - while all other known Type Ia supernovae, being nearer and more recent, occurred at a time of accelerating expansion. Thus it seems the expansion of the universe slowed down and then sped up again. These findings rule out other expansion scenarios that avoid a cosmic speedup. A possible explanation for the acceleration (discovered only in the last three years) is the fabled "dark energy." Although astronomers are far from understanding this mysterious repulsive force, SN 1997ff indicates that it was not strong enough in the dense, early universe to overcome the expected

deceleration due to gravity. Once galaxies finally moved far enough apart, gravity's pull lost out to the dark energy's repulsion and the expansion of the universe began speeding up. The switch took place sometime between 4 and 8 billion years ago, says Adam G. Riess (STScI). "The trick was to find at least one supernova from beyond [that] time."

Learner's Diary. April 2001

from Alex Menarry (CaDAS)

"Blessed are they who can laugh at themselves, for they shall never cease to be amused."

I wonder if any other Members have come across the Science Jokes site on the Web? This rich source of amusement, watering eyes and aching stomach muscles can be found at www.xs4all.nl/~jcdverha/scijokes.zip. They ask for comments and especially contributions to be sent to Joachim Verhagen at jcdverha@xs4all.nl. It's quite a long document, with jokes in several categories - maths, physics, chemistry, biology. There isn't an Astronomy section - we need to make some contributions there. I was sure you would appreciate some of the maths and physics. Many of the contributions are long discourses and spoofs of scientific papers. However, here is my extraction of some of the shorter pieces, which you may not have come across before. First of all a silly question and answer session, which would sit well in the Dandy or the Beano.

Q: What's a polar bear?

A: A rectangular bear after a coordinate transformation.

Q: What is the mathematical name for a toilet seat

A: An ass-toroid

Q: What do you get when you put a spinning flywheel in a casket and turn a corner?

A: A funeral precession

Q: To what question is the answer "9W."

A: "Dr. Wiener, do you spell your name with a V?"

Q: Why did the chicken cross the Moebius strip?

A: To get to the other ... er, um ...

Q: How do you make one burn?

A: Differentiate a log fire.
(that one is subtle)

Q: What's the difference between a quantum mechanic and an auto mechanic?

A: A quantum mechanic can get his car into the garage without opening the door.

Q: What is the definition of a tachyon?

A: It's a gluon that's not completely dry.

Q: What is more useful: the sun or the moon?

A: The moon, because the moon shines at night when you want the light, whereas the sun shines during the day when you don't need it.

Q: How does Santa deliver presents all over the world on Christmas Eve?

A: With Rudolf the red-shift reindeer. Besides, Santa simply realizes all of his alternate quantum states at once. Everybody knows that.

Followed by a selection of "one-liners", well almost : -

Although Euler is pronounced oil-er, it does not follow that Euclid is pronounced oi-clid.

Franklin D. Roosevelt never said "The only thing we have to sphere is sphere itself."

It is true that Johannes Kepler had an uphill struggle in explaining his theory of elliptical orbits to the other astronomers of his time. And it is also true that his first attempt was a failure. But it is not true that after his lecture the first three questions he was asked were "What is elliptical?" "What is an orbit?" and "What is a planet?"

The subatomic particle store had a sale last week.

Electrons: 10p

Protons : 10p

Neutrons : free of charge

There was a young lady called Bright who could travel much faster than light. She departed one day in a relative way and returned on the previous night

Sign on railway station: These railways are subject to Heisenberg's Uncertainty Principle: Position and Velocity of a given train can not be specified at the same time.

A Member was driving her daughter westward after the foot and mouth fires (I have updated this, you understand), when the smoke in the sky made everything look surreal.

"Ooh, Wendy, look at the sun," she told her daughter. "It looks like a big ball of fire." With the tired expression of a 3-year-old talking to a stupid adult, Wendy replied: "It is a big ball of fire."

Einstein's Theory of Relatives:- The probability of them visiting is directly proportional to how much you feel like being alone.

Seen on the door to a light-wave lab: "Do not look into laser with remaining good eye."

Ginsberg's Theorem (The modern statement of the three laws of thermodynamics)

1. You can't win.
2. You can't break even.
3. You can't get out of the game.

Capitalism is based on the assumption that you can win.

Socialism is based on the assumption that you can break even.

Mysticism is based on the assumption that you can quit the game.

The Law of Entropy: The perversity of the universe tends towards a maximum.

Black Holes are where God is dividing by zero.

And a few mnemonics for the order of the planets : -

Mother Very Thoughtfully Made Jam
Sandwiches Under No Protest.
Most Volcanoes Erupt Mouldy Jam
Sandwiches Under Normal Pressure
Many Viscious Earth Monsters Just Sat Under
Nellies Porch
My Very Excellent Memory Just Stores Up
Nine Planets.
My Very Educated Mother Just Sent Us Nine
Pizzas
Most Volcanoes Erupt Mouldy Jam
Sandwiches Under Normal Pressure
Many Voters Earn Money Just Showing Up
Near Polls (attributed to Isaac Asimov).
My Very Efficient Motorcycle, AJS, Uses No
Petrol.

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to John), or Mr. Martin Jenkins, 01642
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