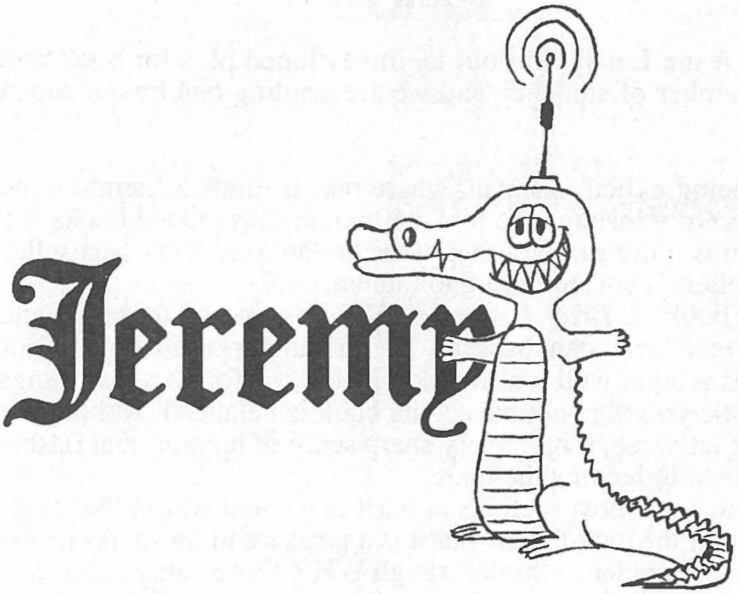

The Official Journal of The University of Sydney Physics Society

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Editorial

Welcome one and all to this, the last issue of *Jeremy* for the year.

In this latest issue there are lots of fun and games, stories to read, etc. etc. We have the conclusion to *Alice's Adventures in Physics One-derland.* There is also the second article about black holes and what to do if your friend becomes one by Andrew Gray. A number of book reviews have been submitted, but due to lack of space only two can be published. To those of you who submitted one, do not jump off The Bridge, it will be published. Of course there are more pages filled with the *Kit Kat* Quote Competition than before along with the winning quote for this year.

In this issue, we have the last *Physics Forum* by Bodie who "will soon be leaving in order to experience the novelty of exchanging labour for monetary rewards". We wish to thank him for all the work he has put in over the past two years and wish him the best of luck in his future career. If there is anybody out there who wishes to take over the position, they have but to apply.

There is an article by James McCaughan in which he argues against Hawking's thesis presented in *A Brief History of Time.* The editors disclaim this view as their own and we are printing it for the general edification of the general public.

We would like to thank Laurie Peak for the generous use of his Macintosh, without which *Jeremy* would not be published. Also we would like to thank Nuria for exceptional and sophisticated 90% speed-of-light typing. Such is the modesty of the typist that we had to forcibly restrain her in order to type the previous sentence. The editor's typing is of the one-finger hen-pecking variety.

We hope that everyone does well in the exams (*you do not! - typist*) and hope to see you all next year.

We apologise to A.Nonymous for not publishing his/her latest article due to lack of space. It will get premiere billing in the next issue. Derek McKay is responsible for the terrible puns on the back page with one of his best works to date. Derek was trying to forcibly restrain the typist during this section.

We received a letter from Tim Anderson demanding an apology for calling him an astronomer. Here it is. Dear Tim, we're sorry you're not an astronomer. Love, Muriel.

The Editors: Richard Planetaganet (Physics II)
Mrs Muriel Pim (Physics II)

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BOOK REVIEWS

In our last issue Anne Lustig sent out an impassioned plea for book reviews. Her plea was answered by a number of students, and we are printing one by our Japanese Correspondent Denise Haworth.

Despite being exiled to Japan, where recent English literature means anything post-Shakespeare, I recently managed to pick up two physics related books. The reason they were available in Japan is quite simple - they were on the New York best seller list. Why either of them were best sellers, I am still trying to fathom.

The first book, *A Brief History of Time,* is one of those advanced physics for the layman books (read as... can be read by and undergraduate without inducing a brain haemorrage). It is a book well worth reading as it reinforces some things you'll have learnt and discusses some you may not have. The book is balanced. Although it is primarily about the physics of the universe, it has a very sharp sense of humour that flashes out here and there throughout the book, lightening the tone.

I needed to read most sections at least twice and would like to go back and read the whole thing again in the near future, but it is a pleasure to do so. As he gives only causes and results, it is up to the reader to think through WHY those causes connect with those results - that is if you are the sort of person who is driven to understand such things completely, and if you are taking physics then you probably are, unless you are lucky enough for it all to seem obvious.

This would be a good book to discuss with friends, if you have any. Beats talking about the books you studied for H.S.C. English yet again!

The only thing that frustrated me about *A Brief History Of Time* was the near complete avoidance of equations. I hate Schrödinger's equation as much as anyone, and complicated equations mean very little to me, but in the case of simple proportionalities, equations say clearly and succinctly what otherwise requires a lot of words. Personally, I would like the equation, followed by the verbal description to make you look at it and consider the relationships involved. As it is, I kept jotting down equations on the scrap paper part of my brain. But, Hawking has a reason to avoid equations and he gives it, so that is fair enough.

A Brief History of Time is a good stimulant for a jaded brain and heaps more fun than Cheng. If you are wondering why the hell you did Physics, this may remind you. Highly recommended.

Surely You're Joking Mr Feynman , a ghost written book of memoirs by Richard Feynman, is a completely different book pitched at a completely different audience (*then why did you read both of them? Ed.*) - just who I'm not sure. The anecdotes don't contain enough physics to be pitched at the scientific community, but on the other hand, in Australia, Britain and Japan, Feynman is unheard of amongst people who have never taken a physics course. Maybe in the USA, as a local Nobel Prize winner, things may be different.

This book will not stretch your brain. At best it is an amusing time-filler. It might be a good book to give you parents if they are curious to know what sort of weirdoes you are working amongst.

The fragmented style makes it convenient for reading on the train but means that while some of the stories are quite amusing or interesting, the whole doesn't really connect and the book left me slightly disappointed. It does, however, contain some absolute gems such as the description of a very cool young Feynman concealing a bedroom fire from his mother's bridge party (anyone ever get a chemistry set for Christmas?).

The section about Feynman's time in Los Alamos is good for getting a prespective on how people working on 'The Bomb' felt and thought at the time and afterwards, without being heavy.

In some ways Feynman is incredible; his ego is enormous. Nevertheless *Surely You're Joking Mr Feynman* is about real life, albeit the highlights of the life of a character a little larger than life. When you think about it there are many things that we all do that for us are just work, routine or necessity, but which someone else would find amazing. It's only from time to time that we step outside ourselves and think, "this would sound really exciting if I read about it in a novel". Feynman has stepped back and put himself into a novel, or at least a series of anecdotes. I wouldn't urge you to race out and find a copy, but you could find this pleasant reading to rest your mind while you wait for your equipment to warm up or cool down.

J

Physics Forum

Bodie Seneta

I think we physicists must be doing a pretty good job solving all the mysteries of the universe, because none of you are sending in any questions, in spite of my plea last issue. Does this mean that we really have, in the space of the two years this column has been in existence, solved all the mysteries there are? In that case, where's my Nobel?

As this is probably the last column I will ever write for *Jeremy*, we will probe three of the areas that have proved most popular with our readers: waves, visual atmospheric phenomena and the kitchen sink.

Sound waves, Thunderstorms, and Really Good Parties

There's a lot of physics in a thunderstorm - so much so that the Physics Society even held a lunchtime talk on it last year. One thing that I rarely hear (no pun intended) mentioned, though, is why thunder sounds the way it does.

A lightning bolt sends a shock wave through the air, which we eventually hear as thunder. This wave, for our purposes, must be pretty close to a delta function - that is, a very short, high powered impulse. Now Fourier transform theory says that an impulse like that contains all frequencies of sound wave, so if we listen to the thunder we can tell all sorts of things about the way the atmosphere transmits different sound frequencies.

Here's what I observe: When the lightning is very nearby, I just hear the impulse, which sounds like an explosion. When it is further away, I hear a kind of crackling which rapidly turns into a rumble and dies away. I interpret this to mean that I am hearing the higher frequencies in the impulse first and the lower ones last, which in turn implies that the atmosphere is dispersive - that different frequencies travel in it at different speeds. When the lightning is a very long way away, I only hear the rumbling low frequencies. I figure that the high frequencies are filtered out by the air, so it mustn't be able to transmit high frequencies as efficiently as low ones. Another way of putting this is to say that the atmosphere is bandwidth limited - there is a limit to the range of frequencies it will transmit. This also explains why all you can hear of the really loud party down the street is the thunderous bass.

What are the hi-fi purists going to do? All that air between them and their loudspeakers must be colouring their sound! They will either have to sit up right in front of those expensive speakers or settle for wearing headphones.

So the atmosphere is dispersive and bandwidth limited. Now for my question: Why? What is the phenomenom that filters out the high frequencies and disperses the thunder? I suspect the higher frequencies might be better at jiggling molecules in the atmosphere and winding up as heat. What do you think?

Why isn't the Sky Blue?

In previous issues we have looked at some visual atmospheric phenomena and the relationship between the colour of ocean water and its latitude. This question is a good sequel to both:

You have all been told, or know where to look up, the answer to the question, "Why is the sky blue?" But think about this one: As with the ocean water, the colour of the sky varies with latitude. I was once in the United States during their winter, and I noticed that

even in the middle of the day, the sky is almost white - a kind of very pale eggshell blue. Sydney skies, by comparison, are a much stronger blue and the colour of the sky in the tropics is the strongest that sky blue ever gets. Can anyone tell me why the colour of the sky varies with latitude?

More Fun with the Kitchen Sink

I once asked a question which allowed all sorts of experiments to be performed in the kitchen sink. Here's another:

Turn on the cold water tap and establish a stream of water into the sink. Now decrease the flow of water very gradually, until all you have is a silent, tapered, very smooth flow that is on the verge of turning into a drip. If you pass your finger through the stream it *will* start to drip. Now the water is moving downward all the time because it is being released by the tap. So when you put your finger through the stream, how does the water at the top know it has to drip and not pour? Somehow a signal must be sent from your finger to the tap along the water path, and in order to reach the tap, it must travel faster than the water itself is travelling down, or it would never get to the top. For example, if your finger was ten centimeters from the tap, the water would already be travelling at about a meter per second downward by the time it hit your finger. In order for information to be transmitted back up, the returning signal has to travel at least that fast. As I reckon that there aren't any eddies present (the flow looks pretty laminar to me) the only thing I can think of is sound waves. Does anyone have any ideas?

There's more to this. When the stream is in the "almost dripping" state you can do some pretty amazing things to it. Depending on the orientation and positioning of your finger, you can make all sorts of patterns appear on the surface of the stream. You can also get the water to look as if it is "piling up" on your finger - when there are some very strong kinks in the flow. This time I think there's some standing waves set up in the water column - and if they are, why should putting your finger into the stream generate them? Does it work like a whistle does?

Feedback

The problem about the mysteries of chocolate and condensation has generated considerable response. Most people said the greatest mystery of all was how I could leave a bar of chocolate unwrapped next to my bed for a whole evening and still have it there, untouched, the next morning. So far, though, nobody has ventured an explanation as to why it should be so good at absorbing moisture.

I thought that when I mentioned dew caps on telescopes, a horde of professional and amateur astronomers would descend upon me and bash me to death for being such a brainless nearsighted twit. Any astronomer should know the answer to a question like that one, right? But nobody seems to be sure just why a dew cap should work. Alan Roy and I have, however, constructed the following hypotheses:

1. As the air contracts and cools down, water condenses out of it and precipitates downward. This explains things like why the sloping windows on cars tend to get more dew on them than the vertical ones, and why trees should stop dew getting on cars and why aluminium foil overhangs stop dew getting on chocolate. This hypothesis says that a telescope's dew cap won't work when the telescope is pointing straight up (are there any

amateur astronomers out there who can verify that point?). The only problem I can see with this one is that if there's all that water falling out of the sky, the hapless astronomer should be sitting in a fog - and yet condensation is often a problem on very clear nights.

2. The water (H_2O) molecule is lighter than either of the major consituents of the atmosphere, nitrogen (N_2) or oxygen (O_2). Hence I would expect that air that is water saturated would be lighter than dry air, because the water molecules displace some of the air molecules (it's not quite like an aqueous solution, where the solute molecules fit in "in between" the solvent molecules). Does anyone want to confirm or deny this? Now if soggy air is indeed lighter than dry air (yes, this seems to be counter-intuitive to me too), then the dry air sinks. So if there is wet air in contact with the dew cap, which gives the water something to condense onto, that air loses its moisture and becomes dry air, sinking to the bottom of the dew cap, where the lens is. Hence a pool of dry air forms over the lens, protecting it from condensation. This hypothesis says that a lens cap should work *best* when the telescope is pointed vertically. It also says that the amount of dew you get on you should depend on how high above the ground you are, as long as it's a still night.

Any takers? Am I really a brainless nearsighted twit?

Alan, who by now is really cleaning up in the kit-kat supply business, also suggests an explanation to another problem from the last issue:

"I can see a reason why mackerel might want to congregate under the boundaries bewtween the rough and smooth water: they do it to avoid the birds. I suggest that they are using to their advantage the phenomenom of "wind shear", which has been responsible for several major airliner accidents in the US recently. How it works is that if a bird (or airliner) is flying into a constant headwind (above the rough patch of water, or on final approach to an airfield) and then encounters still air (above the calm patch, or in the lee of a mountain) the airspeed falls dramatically, and the bird (or airliner) falls out of the sky. The bird can fly equally well in a constant headwind and in the calm air, but the transition region from one to the other is a most uncomfortable place to fly, so they (birds and airliners) avoid it. Apparently mackerel know that they are safer swimming under regions of wind shear. Either that, or they congregate there to eat the birds which fall out of the sky, in a gratifying display of retribution."

I can make two brief comments here. Firstly, this backs up the idea that the surface texture of the water on the harbour is largely dependent on the wind velocity above it, and secondly, that mackerel obviously don't have the evolutionary preparation to cope with fishermen (whose boats can ignore wind shear), which is why fishermen like to fish on the edges of the smooth areas of water. Thanks, Alan, for helping clear that up.

Derek McKay (Physics III) has sent in a solution to the flute problem, which relieves me greatly because it frees me from my promise to follow the thing up with some lab equipment. When you take your finger out of the flute's end, the note goes up and not down because you are changing from a closed end pipe to an open ended pipe, and the fundamental frequency of the open ended pipe is higher, even if the closed end one is slightly shorter because it's got your finger in it. Go back to your first year physics text if you don't believe us.

Derek also thinks that the sparks in train overhead wires look brighter when there's wet weather simply because there is more contrast between them and their (gloomy) surroundings.

Postscript

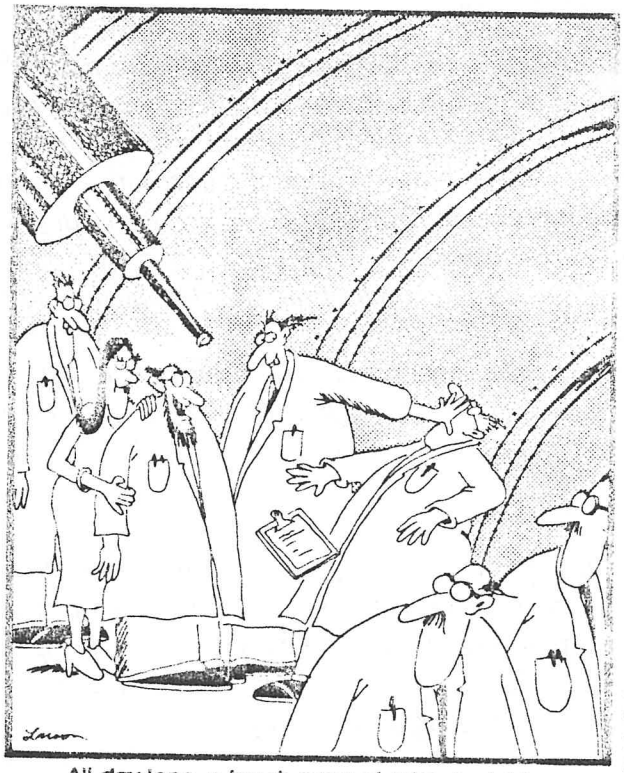
As I have already said, this is probably the last thing I shall ever write for *Jeremy*, which I have contributed to for most of its five years of existence. The reason is that I shall soon be leaving in order to experience the novelty of exchanging labour for monetary reward.

I have tried in these pages to show that physics is good for more than just solving the great mysteries of the universe; it is also a powerful tool for understanding, instead of merely accepting, things we experience simply in the course of living. If I didn't succeed, at least we had some fun along the way.

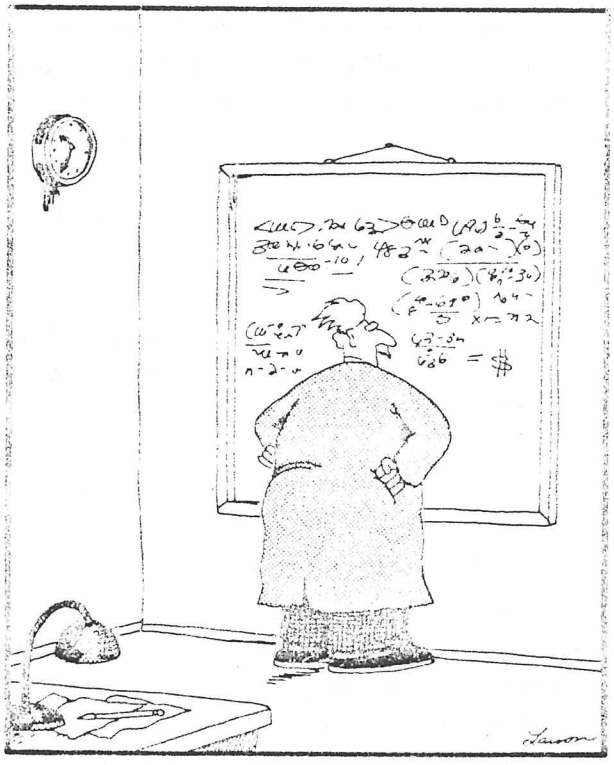
I would like finally to thank all those who have contributed to this column over the last two years. You have kept it alive and well.

Astronomy Department
18th October 1990

J



All day long, a tough gang of astrophysicists would monopolize the telescope and intimidate the other researchers.



Einstein discovers that time is actually money.

HAWKING, IS HE CONFUSED OR JUST MISCHIEVOUS?

by

James B. McCaughan

A student query from Stephen Hawking's book 'A brief history of time' recently brought me to read the latest popularization of physics from one of its better known practioners. The book was a pleasure to read for its clarity and apt examples in presenting the complex but exciting synthesis now being attempted between the very small (sub atomic particles) and the very large (the cosmos) at the time when the latter was the size of the former at the 'Big Bang': the time immediately after their appearance.

Threaded through his story is an argument leading to the proposal that the universe though having a beginning in time and perhaps and end nevertheless can be thought to be always existing and not in need of a Creator. He achieves this remarkable feat, so he believes, by introducing the concept of imaginary time. The mathematical description of the time development of the universe may then be transformed from one with singularities at the beginning and possible end of time (i.e. mathematical points when the equation doesn't exist) to one where these singularities become poles like those of the earth, North and South, where North might be the point in time where the universe began and South might be the point where it may finish. One can move all over such a mathematical surface without meeting any gap where time doesn't exist. Hence his proposal.

The size of the universe at these poles is exactly zero, but because the mathematics exists there, there is a smooth transition to finite size. So the gospel according to Hawking opens with : At the beginning of the World, time already was - but in the equation that produces the universe. What first exists for Hawking is the mathematics, but mathematics has the unfortunate habit of needing a mind to think it and to know it. That equation would first exist within the mind of God and according to Hawking its discovery will lead to our knowing his mind. If one accepts Hawking's blueprint for the universe then God is at least necessary to think the equation; one is therefore astonished to read incautious statements like : 'Nothing for the Creator to do' (Carl Sagan in the introduction to Hawking's book) or 'God is not necessary' (Robyn Williams in 'Here comes the Philistines').

We will only know that equation through the universe that actually exists, not other equations of other universes that could have existed. We will not know the mind of God, as Hawking supposes, but merely a thought of that mind. Our present universe, far from being necessary is contingent on God's thought.

Those of us with a practical side to our occupation may note difficulties with Hawking's proposal being translated into action. Because one possesses the plans to a house, that does not bring the house into existence. Because one knows the equation of the presently existing universe that does not cause its existence. The point in time where the size of the universe is exactly zero is the point where it *doesn't exist in material form.* It requires an act over and above the knowledge of a plan to bring it into existence.

Curiously Hawking is well aware of this : 'The usual approach of science of constructing a mathematical model cannot answer the questions of why there should be a universe for the model to describe. Why does the universe go to all the bother of existing? Is the unified theory so compelling that it brings about its own existence? Or does it need a Creator ... and who created him?' (p. 184). Hawking does not answer his own questions, yet some who write about him act as if he had disposed of them. As for 'who created God?' ,Hawking gave implicitly the answer in his story of the infinite series of 'turtles all the way down' supporting the earth (p. 1). Unless there is a first in cause there can be nothing; something must first have existence before it can give it to something else and this it must get ultimately from something that is existence itself. You cannot give what you haven't got.

Despite this window of lucidity on this difficulty ensnaring his proposal, Hawking does *not* revise its nub expressed on an earlier page: 'But if the universe is really completely self-contained, having no boundary or edge, it would have neither beginning or end: it would simply be. What place then for a Creator?' (p. 149). At this point he is still under the intoxication of having introduced imaginary time so that he confuses the mental existence of his mathematical proposal with the real existence of the universe.

To his own later objections we enjoin that demonstrations of God's existence are all metaphysical and not physical. In particular they do not involve time. God is not found at the

beginning of time winding up the universe, so to speak, but outside time sustaining it in existence here and now. Again Hawking shows evidence of being aware of this: '... But the idea that God might want to change his mind is an example of the fallacy, pointed out by St Augustine, of imagining God as a being existing in time: time is a property only of the universe that God created' (p. 176).

Another curiosity of Hawking's book is that despite its title, he does not tell us what time is. It certainly caused St Augustine a lot of difficulty but he had not read Aristotle. Physicists are concerned with the measure of things and theories or models that can link the measures into a coherent picture. The measure of something should not be confused with the object of that measurement. These pictures that physicists construct are like scaffolding on reality not reality itself. We accept the techniques of construction of the scaffold (the mathematical models) provided they continue to predict the outcome of measurement i.e. the scaffold must be in contact with reality, quantitatively. In particular, the scaffold need not bear any resemblance to the reality it envelopes. There need not be any one to one correspondence between the steps of the mathematical construction and the quantities therein and the real world, only that it begin and end end quantitatively correct.

The external reality is far richer than the skeleton of a scheme that physics reduces it to. These schemes are entirely of our own making, but made to a measure. In knowing what schemes work is to *know our own mind* measuring the external world. This may bring us in contact with the thought of God but then only quantitatively and even then not with certainty as Hawking well remarks twice : 'theories can't be proved' (p. 11, p. 178).

At root the whole program that Hawking and many others set themselves is to give physical answers to philosophical questions, believing that philosophy has abdicated the responsibility (p. 185). The abdication is merely by ideologies, the bastard children of philosophy that seek to start with ideas and then fit reality to their tenets. Hawking, like all the intellectual descendants of Descartes can't break out from the prison of his mind to make reality do the bidding of his scheme. This again he acknowledges: 'A scientific theory is just a mathematical model we make to describe our observations : it exists only in our minds' (p. 147).

Then he immediately goes on to say : 'So it is meaningless to ask : which is real, "real" or "imaginary" time? It is simply a matter of which is the more useful description'. Here he attempts a double deception although the statement is true. What he calls 'real' time is just time's measure. The numbers on a clock face are entirely conventional, i.e. creations of our minds. 12 o'clock could just as well be represented by 1000 o'clock, since it was we who imposed the measure. But 1000 referring to apples would misrepresent the situation if in reality there were only 12. That is the first deception. Imaginary numbers cannot be abstracted from anything in reality, but are found useful among other things in analysing, with mathematics, the response of electrical circuits to alternating currents. The second deception does *not* consist in substituting 'imaginary time' for 'real time' which looks suspicious but in fact is legitimate, as they both only have status in the mind and one scheme is as good as another if it proves useful in facilitating a theory. Rather, the second deception consists in now persuading us that this new time concludes about something independent of the mind; now there is not even a clock face to point to.

Hawking's proposal then cannot transcend his mind or imagination. His god, which he delights in yanking in and out of the scenario like a puppeteer, has the same status as his mathematics. Not only do we fail to know the mind of God, but, on the evidence in his book, we even have difficulty in knowing Hawking's mind. He seems to be aware of the flaws in his argument, if not the untenability of it, yet he does not deduce any consequences for them (why spoil a good story?). Or are these caveats escape routes from bearing the responsibility for what others take to be his conclusion, since he does not withdraw it, that the universe simply 'is'? Is he confused or just mischievous?

Black holes II: Everything you ever wanted to know ... etc.

A.D. Gray, B.Sc.(Hons)

You may remember last time that I outlined why it is best not to be a black hole, and why in general it is best not to have anything to do with them. But what if you are suddenly confronted by a black hole, or worse a NAKED SINGULARITY!!!! Fear not, gentle reader. I will now tell you what to expect.

- black holes do not "suck" things in. They behave just like any other star, and the $1/r^2$ law still applies. The only difference is that you could get much closer to the central potential well. For instance, a solar mass black hole will have a radius of 3 km compared to the solar radius of 700 000 km. Sight-seeing near a black hole is not recommended. Getting stuck in the potential well of a black hole is worse than bogging your car, and could ruin your entire life.

- what we usually refer to as a black hole is the so-called "event horizon", which lies at the Schwarzschild radius for a spherically symmetric black hole, and marks the boundary of causality. This just just means that if you were to venture beyond the event horizon then you will never return to our Universe. So you probably won't want to do that.

- black holes come in any size, but only in basic black. Perfect for inner city living! Very small and very large ones may have formed in the Big Bang (apologies to Creationists), but today only stellar mass ones are likely to be formed (as a result of stellar evolution). As these are all a few kilometres in size you should have plenty of warning when one is getting close.

- black holes have no hair. This seemingly silly statement means that no matter how a black hole was formed, there will only ever be three things by which to distinguish between black holes: the mass, the charge, and the angular momentum. Due to charge neutralisation effects it is unlikely that black holes with significant charge can exist. Mind you, if you get close enough to measure the charge then you probably won't get to tell anyone else about it. If the black hole is spinning then you get two event horizons, but the inner one is hidden by the outer one.

- the distance from a black hole at which one must travel at the speed of light to remain motionless(!) is called the static limit. In a non-spinning black hole this is at the event horizon. Another good reason to stay out of the event horizon! In a spinning black hole a phenomenon known as frame-dragging, in which the black

hole drags local reference frames around with it, like water going down a plug-hole, will cause the static limit to move outwards near the equator.

- the gap between the event horizon and the static limit is called the ergosphere. While it is not possible to remain motionless in the ergosphere, it is still possible to escape, as the event horizon has not been passed. So if you must approach a spinning black hole then stay in the equatorial plane, just to be on the safe-side.

- if an object is thrown into the ergosphere where it splits in half, allowing one half to fall into the black hole, then the other half can emerge with more energy than when it went in! Thus a spinning black hole can be used as an energy source. Unfortunately you probably won't be able to get a black hole to produce 240 V AC, so don't plug your stereo into one.

- gravity can deflect light rays. Since the gravity is quite intense near a black hole there is a certain distance (about 1.5 Schwarzschild radii) from a black hole at which photons will happily orbit. Any closer and they spiral in, and any further out and they escape. Thus there is a sphere surrounding a black hole made up of all the photons which are trapped in this orbit. Again frame-dragging will change this, and we get two radii which depend on whether the photons were travelling around the black hole in the same direction as the spin, or in the opposite direction. This needn't bother you too much, unless you are a photon.

- if a black hole spins at just the right speed then the two event horizons will merge. At this time they will vanish, leaving you with a naked singularity. The same happens if a black hole carries a large charge, except in the former case the singularity is ring shaped, and in the latter it is a point. A naked singularity is a bizarre object. It is dimensionless, so it is quite hard to see, but if you run into one you will be instantaneously crushed to infinite density, so be careful.

So there you have it. Carry this copy of *Jeremy* everywhere you go. You never know when it might come in handy.

This article was written in response to persistent pestering by the evil God of Putrid-week-old-crabmeat-that-was-left-in-the-Sun, sometimes known as Richard Plantaganet because he is too gutless to reveal his true identity.

Reference

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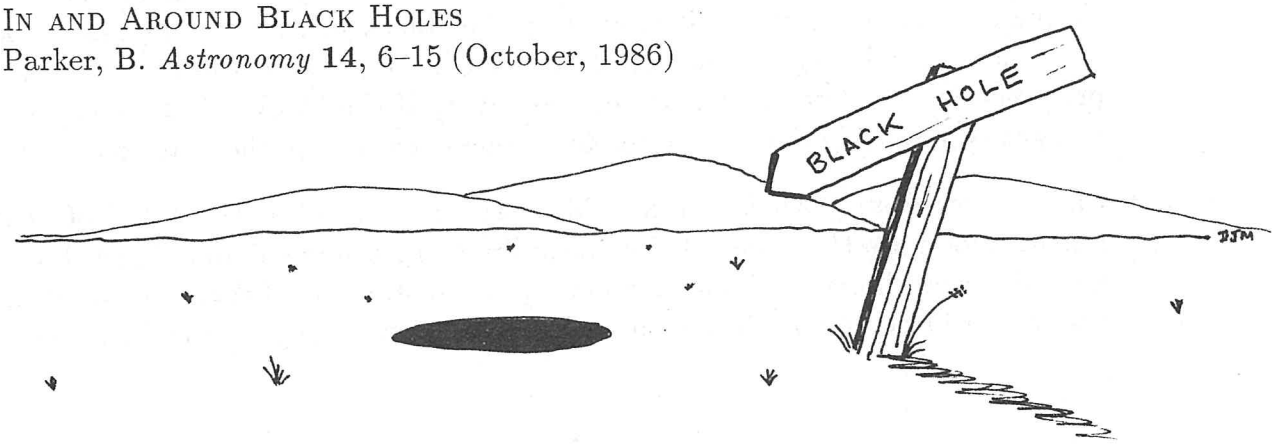


The Kit Kat* Quotes Competition

Welcome to the last of the quotes for this year. The big news on the quotes front is that the winner of the *Kit Kat* Quotes Competition has been decided by the traditional semi-democratic-jelly-bean vote at the last Physoc party. The winning quoter was ...

Dr Les Wood (guest lecturer for 3rd year):
"The mathematician follows the elephant with a bucket and shovel. The physicist rides the elephant telling it where to go"

submitted by Quote Collectors Incorporated (along with the majority of other quotes). They say they'll go for 3 in a row next year. The winners received one box of *Kit Kats* and a selection of books. The trophies are presently being engraved and will be displayed shortly.

Dr Les Wood, awfully embarrassed by the attention has returned to his home campus of Cambridge. We do not know if he will return next year to repeat this feat. Physoc will be in contact with him... if we find him, to award him his prize, or we might keep it ourselves.

We'd like to thank all the people who participated, both lecturers and students and look forward to a bigger and better competition next year.

So here are the final quotes for this year

Lawrence Cram:
"Some of you know, the school's been looking at women"
"You'll have to excuse me, my mind is on the wrong track: I just had lunch with some women"

Ian Faulkiner:
"My god, you guy's are in trouble"
"Can you guy's check for any bags or umbrellas left by the geriatrics in the talk before you?"

John Davis:
"And then there is 'Frankyl' which you know but do not love"

Ian Johnston:
"Whatever you do don't worry. The Lord will provide. Well, the physics department will provide... same thing really"

Juris Ulrichs:
"How many physics students does it take to run a computer?"[in reference to students processing Jeremy quotes.]
"Now don't read this reference in too much detail; read it like a novel."

Rod Cross:
"The sun will expand and cool in 5 billion years... but you don't have to worry about it ... except for exam purposes."
"We're not interested in making them (H- Bombs) but in making them more elegantly"
"It's generalised in the sense that it is general"
"It's almost correct, except that it's totally wrong"
"And then the current drops from 5 million amps to zero... the technical name for this is a major disruption"
"I hate writing lots of mathematical equations. For one thing my mouth gets full of chalk"
"I'm not a perfect point source, unless I've got a hole in the back of my head"

Paul Walker:
"I said from the beginning that my jokes were bad.I say them just to irritate you into learning something"
"Chemistry is just the physics of the outer electron"

Brian James:
"I've put the solution in the lab... actually it's not really my solution, A student did it last year"

John Lehane:
"Does your demonstrator know what's going on?... Oh, I'm your demonstrator."

Colin Sheppard:
"Fresnel diffraction occurs at distances greater than infinity."

Michael Large:
"I don't expect you to understand what i said, except in the vaguest form"

FØRƎIGN QUOTES
Anthony Nelson(Pure Maths)**:**
"Don't look to closely, in case I've done something wrong here"

Philip Kirkpatrick(Pure Maths)**:**
"There's a nice application of the fact that 1+1=2"
"This is the clever bit: you write down some extraordinary thing you'd never think of and see what you can do with it."
"Mathematicians are obsessed with tidiness. Hey! don't you look at my clothes!"
"You'll notice that every day, my use of the blackboard gets that little bit more clever."
"Transformations are like putting your shoes and socks; it makes a difference the order which you do it in."

Neville Webber(Mathematical Statistics):
"So the probability that this returns to zero is one. But this doesn't mean that it will always happen."
"It's hard to get a warm inner glow when you've got a formula like that."
"I'm not saying this is sensible, I'm saying it's an example."
"This theorem is like the National Anthem - everybody knows it, (pause - laughter), no, actually it's a lot like the National Anthem - everybody knows it exists, but they're not sure about the details."
"There is a lot of flapping of hands and approximalities in that proof. I won't make them all explicit."

Bob Walters(Pure Mathematics):
"I threw 20 people out of Maths 1 this morning... It was fantastic!"
"This is a crucial fact, like everything else in this course."
"Who understood? You can lie. 1,2,...3..., any more lies?"
"... and this, of course, is wrong, but it's not."
"Mathematicians never use ordinary words when they can avoid it."
"I'm very relaxed today; I didn't throw anybody out of Maths 1."

John Robinson(Mathematical Statistics):
"There are only two we need to know. 'Independent' and 'Mutually exclusive', which is just one word for the purpose of this course."

K. Choo(Pure Mathematics):
"That thing for potato - I don't know what it is called... Potato Smasher."

Michael Wise(Computer Science):
"If it's 'less than', we go left, and if it's 'smaller than', we go right, OK?"

Jeff Kingston(Computer Science):
"That's why I needed the dollar sign. Without it I would have fallen off the left side."
[talking about an early computer scientist] " ... so he said ' Well, I can draw squiggles on a piece of paper , and if I do enough squiggles on a piece of paper, I'd have a proof.' He needed a computer for this."

Don Cartwright(Pure Mathematics):
[to someone in front row] "Would you stop fiddling please? If you want to fiddle, then sit in the back row."
"I was wondering how this proof was going to go; It's not going to go at all - I was proving the wrong thing."
"So the sequence converges by theorems I know and you don't

James Ward(Pure Mathematics):
"It's clear the physicists are talking about something. It's useful, practical, but it's not quite clear what it is."
"Use some of the vector identities that you don't know."
"In the old days, when we couldn't do something, we'd set up an axiom that said the result was true."

Peter Harrowell(Theoretical Chemistry):
"Yes, well that's actually due to developments made in the 1930's.Before then only letters like 'i' and 'n' were used as subscripts but then it was discovered that all the alphabet could be used."

Bob Gilbert(Chemistry):
"When I first started here as a young and innocent lecturer... when I first started here as a young lecturer."

SOME REALLY FØRƎIGN QUOTES
Sid Bourne(BIO-RAD Digilab, USA):
"... as for the phenol - if you use your imagination you can see it here" [Pointing at spectrum].

Various(Cambridge University, UK):
" I don't want to go into this in detail, but I'd like to illustrate some of the tedium."
"A 1 x 1 matrix has one column and one row and the same number in both."
"If you haven't written it in green - your notes will be wrong."
"Unless 'x' is a banana, or some other such object that commutes with 'A'..."
"I shall explain this by waving my hands about in an appropriate manner."
"It's OK to divide by zero provided you don't cancel it."

J

Australian Physicist Gets Nobel Prize: "Give it back!" says Stockholm.

And the news this issue is, uhm... the great *Physoc 'The End is Nigh'* Party, at which the *Kit Kat* Quote Competition was decided. The party continued into the small hours of the night with drunken physicists roaming the building in large packs.

On the talk front, there have been many talks, the highlights of which have been Bob Gilbert talk *A Chemist,* and Dave Malin from the Anglo-Australian Observatory, talking about the physics of the photographic process. Next year we hope to continue this fine tradition. The informal discussions will continue next year as they have proved to be a great success.

On the finance front, the raging battle between the editors trying to send *Physoc* bankrupt and the treasurer trying to keep us above water appears to be slowing down with the editors winning. However, the sale of T-shirts is all that keeps us from the bankrupcy court. So if you haven't bought a T-shirt, hurry up and buy one.

We hope to see you all at O-Week next year, eager to renew your membership, to give us enough funds to hold more parties and publish *Jeremy*.

Any of you who long for power will be able to get on the Executive next year to help in the running of the *Physics Society*. Any massochists out there can apply for the position of Editor of this esteemed journal.

J

Alice's Adventures in Physics One-derland

by David Mar and Kim Lester.

Chapter Four

Alice's Evidence

Alice waited till the Cheshire Johnston's eyes appeared, and then nodded. "It's no use speaking to it," she thought, "till its ears have come, or at least one of them." In another minute the whole head had appeared, and then Alice began an account of what had been happening to her, including being witness to this most strange examination of students (all of whom were playing cards). The Johnston seemed to think that enough of it was now in sight, and no more of it appeared.

"Who *are* you talking to?" said the King, coming up to Alice, and looking at the Johnston's head with great curiosity.

"It's a friend of mine—a Cheshire Johnston," said Alice: "allow me to introduce it."

"I don't like the look of it at all: it must be removed" said the King very decidedly; and he called to the Queen, who was passing at the moment, "My dear! I wish to have this Johnston removed!"

The Queen had only one way of settling all difficulties, great or small. "Off with his head!" she said without even looking around.

"I'll fetch the executioner myself," said the King eagerly, and he hurried off.

"I think that I shall be off," said the Johnston to Alice, as soon as the King had vanished from sight. "I expect that you will be wanting to be getting on with your studies." And so saying, the Cheshire Johnston disappeared once again.

Alice thought that this would be a very good time to do some more exploring, especially with the King about to return with an executioner, and so she quietly slipped out of the room and wandered down the hall. She very soon came upon a Gryphon, lying fast asleep in the sun.

Alice blinked in astonishment at the sight of such a strange creature, when it suddenly opened its eyes and gave her a penetrating stare. "Don't you know that it's rude to stare at people?" it said. Alice was just about to say something when the Gryphon jumped up and said, "Well, don't just stand there; we haven't much time. Let me take you to see the Mock Collins, so that it can tell you its history. My name is Cram, by the way. I expect you'll be doing my quantum mechanics course next semester? Come on!"

"Everybody says 'come on!' here," thought Alice, as she went slowly after it: "I never was so ordered about before, in all my life, never!"

They had not gone far before they saw the Mock Collins in the distance, sitting sad and lonely on a little ledge of vacuum deposited thin film solid state semiconductor devices, and, as they came nearer, Alice could hear it sighing as if its heart would break. They went up to the Mock Collins, who looked up at them with large eyes full of tears, but said nothing.

"This here young lady," said the Gryphon, "she wants for to know your history, she do."

"I'll tell it her," said the Mock Collins in a deep, hollow tone. "Sit down, both of you, and don't speak a word till I've finished."

So they sat down, and nobody spoke for several minutes. Alice thought to herself, "I don't see how it can *ever* finish, if it doesn't begin." But she waited patiently.

"Once," said the Mock Collins at last, with a deep sigh, "I was a Dick Collins. Until an accident involving liquid nitrogen, some radioactive isotopes and a tokamak left me with all of this hair." The Mock Collins gestured despairingly at the luxuriant growth of hair on its head. "But enough of that. Shall we dance a Physicist-Quadrille?"

"Oh yes," said Alice, "I would very much like to see it."

The Gryphon and the Mock Collins got up and faced each other. "We really need the Cheshire Johnston to sing," said the Gryphon to the Mock Collins, "but you will have to do. I've forgotten the words."

So they began to solemnly dancing round and round Alice, every now and then treading on her toes when they passed too close, and waving their fore-paws to mark the time, while the Mock Collins sang this, very slowly and badly:–

"Will you walk a little faster?" said a chemist to a kangaroo,
"There's a lawyer close behind us, and he's threatening to sue.
See how eagerly the physicists and the biologists all advance!
They are waiting on the shingle — will you come and join the dance?
Will you, won't you, will you, won't you, will you join the dance?
Will you, won't you, will you, won't you, will you join the dance?

"You really have no notion how delightful it will be
When they take up the engineers and throw them out to sea!"
But the 'roo replied "Too close, too close!", and gave a look askance —
Said he thanked the chemist kindly, but would not join the dance.
Would not, could not, would not, could not, would not join the dance.
Would not, could not, would not, could not, would not join the dance.

"What matters it how far they go?" his chemist friend replied.
"There is another shore, you know, upon the other side.
If they want to fish them out, then they can take that chance —
So turn not blue, beloved 'roo, but come and join the dance.
Will you, won't you, will you, won't you, will you join the dance?
Will you, won't you, will you, won't you, will you join the dance?

"Thank you, it's a very interesting dance to watch . . ." said Alice; but as she turned to look at them again, they had vanished. "Oh, how curious," she thought.

The very next thing she knew, Alice was being ushered into what appeared to be some sort of courtroom — where the King and Queen of Hearts were sitting on thrones — by a great stream of the playing card students who had been sitting the examination not so long ago. They sat at long benches, and Alice looked up to see the White Rabbit, standing behind a lectern, and reading verdicts from a long scroll of paper.

"Bring forward the first defendant!" ordered the Queen. A cowering student came forward and knelt before the thrones. "And what do we have here?" she asked of the White Rabbit.

The White Rabbit put on his spectacles and consulted his scroll. "This student achieved a mark of ninety-nine out of one hundred, your Majesty."

"A failure!" roared the Queen, "Off with his head!"

"Now, wait a minute!" interrupted Alice, who knew when something wasn't quite the way it should be. "I think that you are being just a little unfair!"

"What impertinence!" shouted the Queen. "Of course it is fair to punish those who haven't performed satisfactorily in their final examinations!"

"Stuff and nonsense!" said Alice loudly. "The idea of calling ninety-nine percent a failure!"

"Hold your tongue!" said the Queen, turning purple.

"I won't!" said Alice.

"Off with her head!" the Queen shouted at the top of her voice. Nobody moved.

"Who cares for you?" said Alice. "You're nothing but a pack of cards!"

At this the whole pack rose up into the air, and came flying down upon her; she gave a little scream, and found herself lying on the bank, with her head in the lap of her sister, who was gently brushing away some dead leaves that had fluttered down from the trees upon her face.

"Wake up, Alice dear!" said her sister. "Why, what a long sleep you've had!"

"Oh, I've had such a curious dream!" said Alice. And she told her sister all of the strange Adventures of hers; and, when she had finished, her sister kissed her, and said, "It *was* a curious dream, dear, certainly; but now run in to your tea: it's getting late." So Alice got up and ran off, thinking while she ran, as well she might, what a wonderful dream it had been.

The End.

The Reverend Charles Lutwidge Dodgson, also known as Lewis Carroll, was a member of the Oxford University mathematics faculty from 1855 to 1881, and wrote many treatises on the subject of mathematics. He also happened to write, in 1865, Alice's Adventures in Wonderland*; as well as* Through the Looking Glass *(1871) and* The Hunting of the Snark *(1876). This very free adaptation (very,* very *free) of his work is intended as a tribute, and a thanks. — DM, KL.*

The PHOTON of the OPERA

ΔΙΣΑ

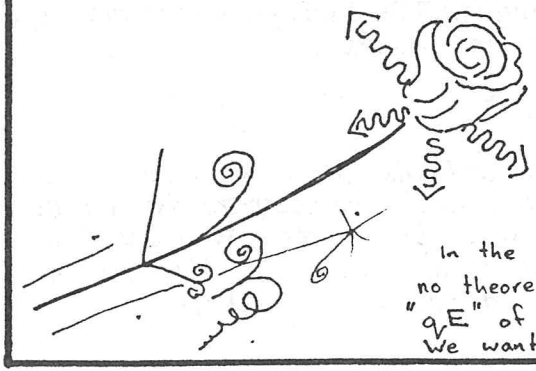
MUSICAL NUMBERS

music by Lloyd-Wb
(where $Wb \equiv T.m^2$)

THINK OF MESON.
ANGSTROM OF MUSIC.
THE PHOTON OF OPERA.
THE MUON OF THE NIGHT.
PRIMA FOCI.
ALL I ASK OF ν.
WISHING YOU WERE MC^2 AGAIN.
EVENT HORIZON.
(THE POINT OF NO RETURN)

While sleeping through a tute,
in dreams it came;
that voice that calls to me,
and speaks my name.
"Wake up you lazy sod!
and do part 8."
The Photon of the Opera is there,
But you are late.

Those who have used hν,
draw back in fear
Equations strike at you
and fill your ears.
You hear the Lecturer,
begin to wail...
"The Photon of the Opera will now
Make you all fail!"



In the interests of the public
no theoretician will be let within
"q.E" of this performance...
We want our sound system to work!