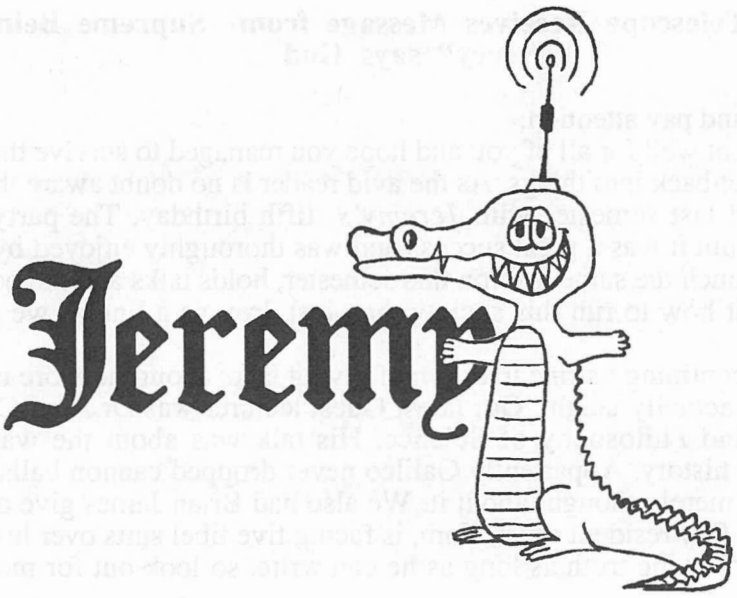


The Official Journal of The University of Sydney Physics Society

Volume 6 Number 3 August 1990

Editorial

Hello, good evening, and welcome to the show.
Actually I'm not David Frost - I write all my own material - but, gentle reader, you have a new co-editor. I could no longer ignore the heartrending cries of Richard for help, succour, and someone to do the typing. So blame him. Like Richard, I am too craven a coward (*modest is the correct word*-RP) to reveal my true identity, but you can call me Muriel Pim. (And if you can figure out the sketch from which I stole the name, you're older than you look!) Well. How does one write an editorial?

I hope your collective holidays were both restful and exciting. We, your ever-concerned editors, trust that you did not spend too much time either: a) feeling suicidal about your exam performances, or b) suffering the after-effects of celebrating them. To ease the pain of starting a new semester, we have prepared a fun-filled issue for you. Try it. You'll like it. Physics Forum is back, bigger than ever. We believe that, given time, it will expand to fill all available space. The same applies to the Quotes Competition, but of course there's a good reason for that. Dr Sue Law has prepared a report on her work in the School.(Sorry it took so long to get printed - *mea culpa!*) We have another issue of 'Alice's Adventures In Physics One-derland', completed at great personal cost and under threat of physical violence from the editors. Then there's a book review, an article on black holes, and... oh, lots of stuff. Even as I type, Richard is writing another chapter of his epic. I hope.(*You'll get it in the next issue*-RP) And - ta daa! - we can finally reveal the winning T-shirt design. Remember that?As always, we'd like to finish with an earnest and heart-felt plea for more contributions. You've no excuse now : the mail box is being moved so that even yours truly can reach it - and if I can, you can. Other than that, its in the same place : in the mail room, near the lift opposite Lecture Theatre Eight. So come on, write! You can do better than this.

All you non astronomers out there ought to feel ashamed. All contributations to this journal are either from Astro-physicts or Astronomers. Can people in other departments write, or what is it about looking at the stars that makes people want to write in to *Jeremy*. Perhaps we can have a special non-astromer's issue with every article written by non-astromers. Anyway its up to you to send in your articles.

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

J

Hubble Telescope Receives Message from Supreme Being- "Sorry" says God

Now class sit up and pay attention.
We hope last semester went well for all of you and hope you managed to survive the exams. Anyway here is the ideal way to get back into things. As the avid reader is no doubt aware the activities of the glorious Physoc finished last semester with *Jeremy's* fifth birthday. The party was held in the slightly soggy backlawn but it was a great success and was thoroughly enjoyed by all. The *Physics Society* will continue in much the same fashion this semester, holds talks and the occasional party. If you have any ideas about how to run this society then just drop us a line as we always need new ideas.

Physoc has been contining its fine tradition of giving talks about the more interesting aspects of physics that are never actually taught. Our latest Guest lecturer was Dr Alan Chalmers from the department of History and Philosophy of Science. His talk was about the way myth becomes incorporated in scientific history. Appartently Galileo never dropped cannon balls from the leaning tower of Pisa, instead he merely thought about it. We also had Brian James give a talk about lasers which was well received. Our resident artist, Tom, is facing five libel suits over his posters but have vowed to continue spreading the truth as long as he can write, so look out for more posters telling you what's on.

Those of you with talented memories will no doubt recall Ian Johnston's last talk about physics and musics, which is now the basis for his latest best seller 'Physicists of Penzance'. A book devoted entirely to the subjects of Physics and Music. Anyway the great author has consented to take time out of his busy book signing schedule to give us another talk. This time it was about 'Bell's Theorem or Does the universe have a consciousness' , no doubt the topic of his soon to be released romantic novel about a Theoretical physicists who has an affair with an engineer, only to find society forcing them apart.

Finally we can announce the winner of the great T-Shirt design competition. After long deliberation on the part of the judging committee the whole process was hijacked by Pal Fekete who takes the phrase 'one man, one vote' to mean that his is the man and he has the vote. Anyway the winner is Dino Ho who designed the front and Pal himself who designed the back. Both designs can be seen on later pages of this issue. Dino will get his prizes as soon as we remember what they are and Paul will get what he deserved. Actually Pal has done a lot of work on the T-Shirt and it would have remained a dream if he hadn't taken the project in hand. It will be printed as soon as we can persuaded the Union to cough up some funds.

How To Write An Article For *Jeremy*

Perhaps the reason why we get so few submissions for articles is that people are unsure as to what style to write in and in fact they have lots of ideas for articles but don't know how to write them down. Well this short section is designed to stop that and hence ensure that all the readers will be able to submit an article for the next issue. So below is a few pointers to get you stared.

Plagiarism : Unlike most academic journals in publication we favour this method of writing. All you have to do is find an article you like and replace names like Gertude by Uncle Brian or any other member of the staff. Most of the best articles are written this way.

Copy : Find an article you like it; doesn't matter where (Computer Bulletin Boards are a good source). Photocopy it and send it in. You can do the same for cartoons and we have files of copied cartoons for various newspapers, but we still want more.

Steal : This one is quite simple: find somebody who is writing an article for Jeremy, wait until they have finished it the 'borrow' it. We will of course deny having received it but it will go into the issue anyway.

Blackmail : Blackmail somebody else to do for you. This method is very successful and it has already resulted in a number of articles by postgraduates in the Astro-Physics department. The problem with this method is that you require a lot of evidence before they will cooperate. The going rate is about a five years jail term to every page written.

Writing : This is the hardest and should only be practised by trained students. It involves thought and originality. It is best practised in conjuction with method one.

Remember to get those articles in for the next issue as you now have no excuse not to.

J

Where Have All The Female Physics Students Gone ?

by

Dr. Sue Law

I'm not sure whether this should be sent to the Physics Forum or just stand by itself. On the one hand it is not, as such, a Physics problem, though we need all the ideas and responses we can get. On the other hand, it is too serious to stand on its own in a prestigiously non-serious journal like *Jeremy*. The problem is epitomised by my activities in the week of 7th May when, to the disgust of the male students, I sent lunch invitations to all the women students from second year up to post graduate, ALL THIRTY THREE OF THEM (yes, that's right, 33). Of these about twelve are engineering students, which leaves twenty later year female Physics students. Why do so few when we have a good, healthy first year enrollment of 125? (Not to mention 170 in the 1LS course and 10 in 1E.)

Why, having started in Physics 1, do the women drop out at such an anomalously high rate? Over 25% of male students in Physics 1 proceed to 2nd year. Less than 10% of female students do. This fact is the cause of the apparently sexist invitations in May. We felt we needed to talk to the students themselves away from the possibly inhibiting presence of their male peers. We aired such possibilities as: segregated lab classes; seminars on Women in Physics; and attempts to educate 1st year males.

It was pleasing to note that the idea of segregated labs and tutes was rejected by all later year and most 1st year students. The reasons given were mature and considered; that segregation in 1st year merely delayed the problem and increased resentment from the male fraction of the class. It was admitted though that there can be problems in mixed groups, due to the presence of a certain type of male student (macho and overconfident). The re-education of this group was regarded as impossible.

While segregation was rejected, the later year students all felt that isolation can be a problem. When the engineers are included, less than 25% of Pysics 1 is female. There is a good chance that a female student may find herself in a lab class that otherwise consists entirely of men. The prospect can be nerve-wracking and lead to loss of confidence and self-esteem, two characteristics in which 1st year women are, on the whole, already low. These conditions are rarely, if ever, experienced by male students and their understanding of them is non-existent, exacerbating the problem. This problem can be overcome by ensuring that the female students occur in clusters of four or five in lab groups, and this aspect will receive attention from the 1st year administration.

As stated above, there is much evidence from overseas (and anecdotal evidence in Australia) that women enter university with much lower confidence levels than men, and tend to underrate their abilities. We asked the students if they were aware of this problem and if they thought it might affect their course decisions. The first year student were, on the whole, unaware of it and could not say whether it would affect them. The later year students felt that by the time one reached second year, most students had become aware of this and probably adjusted for if when making decisions. They were undecided as to whether lack of awareness could lead a student into dropping Physics unnecessarily.

The idea of seminars on Women in Physics met with guarded approval, with the proviso that attendance be open to all students, male and female.

These could look at such subject as: overseas studies of women's problems; career possibilities with a Physics major; talks from practising women Physicists and Physics majors; and famous (and forgotten) female Physicists of the past. The aim will be to raise awareness of these matters amongst the student population as a whole.

Much blame was laid on poor teaching of Physics in High Schools. I don't know whether all-girl schools are worse off in this respect, or whether girls (being less confident) are more susceptible to bad teaching, but this cannot be regarded as a purely female problem. Besides which, all we can do about it is to produce more good Physics majors, some of whom may feel the call to teach.

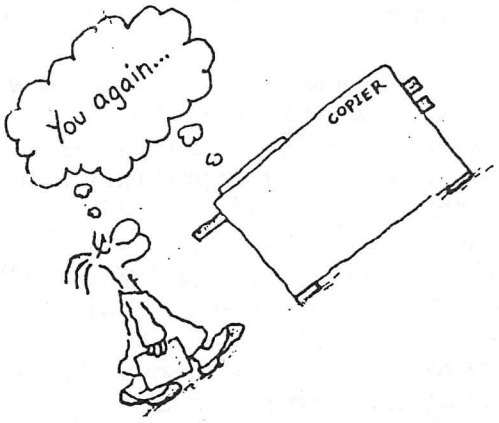
While this project may seem sexist to some, the present situation is far from being non-sexist. While female numbers remain low, isolation will always be a problem and the number of women in the Physics labour pool will remain low, reducing the chance Physics departments have to employ female lecturers and tutors. In any case, I believe that a carefully introduced and run project will increase numbers overall, not just the percentage of women.

All ideas and suggestions (serious or humorous, but please not facetious) will be gratefully received. If you can't find me (room 226B, X4235) Elizabeth in the 1st year office will always take a message.

By the way, does anyone know the source of the myth circulating in 1st year that female students do badly in the 1st year exams? Believe it or not, this was the main reason put forward (and generally agreed to) by the first year students for the high drop-out rate.

J

'It's no use, Crick, we'll never discover the structure of DNA. Better make that a double, Felix.'



Fundamental Definitions of Lecturing

by Tim Anderson

(In response to "Fundamental Definitions of Physics" from *Jeremy* earlier this year)

Simple Proof: Any proof omitted because the lecturer can't do it.
Partial Proof: Any proof involving the lecturer pulling the wool over the students' eyes.
Example: Device used to transform the previous material from utterly incomprehensible to merely quite difficult.
Theoretically Interesting: In theory, the students could be interested. In practice they are bored stiff.
Exam: Device used to determine how many of the students understood a word the lecturer said.
Assignment: Device used, in conjunction with an Exam, to discover how many students just copied.
Textbook: Something made available if the lecturer wants lectures to be skipped by 25% of students.
Lecture Notes: Something made available if the lecturer wants lectures to be skipped by 75% of students.
Additional Material: Material included to determine which 75% skipped the lectures.
Handout: Something provided if the lecturer doesn't want students to listen for the next 10 minutes.
The Sefton Principle: States that if you make sure that the first lecturer a group of first years have is the one with the most entertaining examples and demonstrations, then students might not learn to skip lectures. Even if they do then the lecturer may still get to be guest of honour at a party or something. Named after Ian Sefton, the physics lecturer whose favourite tool for demonstrating principles of motion was jelly.
The Gagen-Robinson Principle: States that the biggest difference between male Heads of related but different schools is the presence (or absence) of a beard. Named after the Heads of the Schools of Pure Mathematics and Mathematical Statistics respectively. Compare them in lectures or when they leave Carslaw together.
Tutorials: Usable in mathematics, statistics, chemistry and physics as a demonstration of exponential decay.
Computer Tutorials: Hoping that the incentive factor outweighs the boredom and laziness factors.
Computer:
1. Labour-saving device that doesn't work 60% of the time.
2. (In Madsen building)
    a. (staff) Labour-saving device that doesn't work 90% of the time.
    b. (students) Labour-causing device that doesn't work 90% of the time.

Practical: Time when students discover that everything the lecturer said is true, except when applied to the real world.
Lucky Dip: Finding out who doesn't have to lecture this year.
Lucky Dip Booby Prize: Having to lecture first year students. None of them understand what the lecturer says.
Lucky Dip Double Booby Prize: Having to lecture honours students. Not only do they understand the lecturer, they can pick holes in everything.
Equation: Something used to keep the students happy.
Greek Letters: Something used in an equation to keep the students confused.
Vectors, Integrals, Partial Derivatives: Ditto.
School Teacher: Someone who doesn't mind long hours, low pay, and being stuffed around by the government.
Lecturer: Someone who doesn't mind long hours, low pay, and being stuffed around by the government, just as long as they get to live on stale bread and water for five years first.

And finally, one that the other article left out:
Quantum: Word misused by many idiots (especially politicians) trying to impress the general public.

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Memorandum

5 June 1990

To: Jeremy

From: Anne Lustig

Subject: A piece for Jeremy

Its time Jeremy started doing book reviews, after all, all the best scientific journals have them. Perhaps you could make them a regular event - get a second year to review a textbook etc. With the purpose of increasing the general education of physics students I submit the following. You are free to correct spelling, change paragraphs etc. at your whim:

It has come to my attention that a number of scientist/engineers have not read or even heard of the book Red Dwarf by Grant Naylor. This is surprising, given the number of such animals who are into Science Fiction and Fantasy. I don't expect them to have seen the inital series as it was screened in the prime time slot of 5pm on a Sunday on the ABC, but anything with a cover that reads 'Infinity Welcomes Careful Drivers' should have attracted some attention. Not even Galaxy Bookshop seems interested despite an apparently large (if not entirely sane) following in the UK. This, and persecution from a certain second year student who resembles Jesus in an Akobra, has forced me into action.

For those of you who really need a good laugh this book is a must. Try reading it instead of studying, you may get a psychological advantage over other students by just laughing all the way through your exams. I gave this book to my brother (an aircraft maintainance apprentice with QANTAS) and his response was along the lines of 'but I've read a book, I don't need to read another one'. Nevertheless, he could be heard actually staying up late at night reading and chuckling. One of the other postgrads, Peter Edmonds, read it twice and kept my copy (I have bought another one).

For those of you who did catch the series on TV, some of the visual humour pales a bit in print form (it took me quite a while of whatching the James Brown-type creature that evolved from a cat licking its clothes before I realised it was doing the washing) but this is amply compensated by the most amazing personal insights. The chapter on procrastination over exam study is a gem: it starts on pg 62 and you may think of it everytime you draw up a revision timetable.

A suppose a run down of the story would be appropriate though I don't want to give the impression that the storyline is an important feature of the book. The plot vaguely consists of a ship which has suffered a nuclear accident:

'He heard what sounded like a nuclear wind roaring up the corridor. It was, in fact, a nuclear wind roaring up the corridor.'

The only 'survivors' are the ship computer who has an IQ of 6000;

'Its only as much as 12 000 PE teachers',

a hologram of a dead crew member;

'He'd always deluded himself that the problem was he hadn't met the right girl yet. Now, given that the human race probably no longer existed, coupled with the fact that he had passed on, even he had to admit there was more than a possibility he was leaving it a *little* on the late side.'

another crew member who was in suspended animation when the accident happened (very much a Bill Oddie type character) and the afore mentioned creature who evolved from a cat over the thirty million years between the accident and the continuation of the story. The rest of the plot is about what you do if you find yourself in their situation.

Read it.

BEFORE THE BIG BANG:
NEWS FROM THE HUBBLE LARGE SPACE TELESCOPE

The Astronomer was red-eyed, pale,
his face was gray with stubble;
he was 13 on a sliding scale
of 1 to 10 in trouble.

"Is Physics just a fairy tale?"
he asked, and then began to wail,
"Why DID we seek the holy grail?
Why did we launch the Hubble?

The launch was good (relax, exhale)
the data systems did not fail
we peered beyond the cosmic veil,
the anti-cosmic double

to back before the quarks prevail.
We digitized each dark detail
but it was all to no avail,
it burst our pretty bubble."

"WHAT did you see?" I asked "Before
Beginning Big Bang lights?"
(I reviews and interviews. I edits and I writes.)
"Before the start of Time, before the Universe's Birth,
What DID the Hubble show, ten billion years before the Earth?"
He told me. Now I writes no more.
I drinks a bit. I edits.
"Right before the Beginning," he said,
"is when THEY roll the credits!"

(Previously published in
"Rhysling Anthology, 1987" and "Star*line, Nov/Dec 1986")

Black holes I:
How (and why) not to become one.

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

Try this experiment: get on the floor and roll yourself into a ball. Get a friend (if you have one) to measure your maximum size (yes, I know that size isn't important, but that's your fault for being smutty, isn't it?). It is highly unlikely that this size will be any smaller than half a metre or so. Roll yourself into a tighter ball, again getting your friend to measure your size. Keep doing this until your size is less than about 10^{-25} m. You will probably experience some difficulty in doing this, as the size of an atomic nucleus is about 10^{-15} m, and most measuring implements are not marked in 10^{-25} m intervals, but perservere. Life wasn't meant to be easy.

Once you have managed to roll yourself into a ball of the required size you will find that you have become a black hole. This is because you have compressed yourself to lie entirely within your *Schwarzschild radius*. If any massive object is reduced in size until it lies entirely within a region whose maximum dimension is twice the Schwarzschild radius, a size which is proportional to the mass of the object, then it becomes a black hole. The Schwarzschild radius of the Sun is about 3 km, that of the the Earth is about one centimetre, and the Schwarzschild radius of the Moon is 0.1 mm! (If anyone can use the phrase "Schwarzschild radius" more often but in fewer meaningful sentences then please send me your masterpiece written on the back of a hundred dollar note. The most creative entry will receive a FREE copy of the next issue of *Jeremy*).

The best (*i.e.* the most foolproof) way to *avoid* becoming a black hole is to attempt the above experiment during your regular laboratory session. The second best way is to not do the experiment at all (you might think that this an equally good way of not becoming a black hole, but there is in fact a miniscule but non-zero probability that you will spontaneously form a black hole even if you don't do the experiment. This means that the first method more reliable).

An interesting property of black holes is the fact that they actually evaporate at a rate which is inversely proportional to the square of their mass, and consequently that their black-body temperature rises in inverse proportion to their mass. When I say that this is a fact I really mean that some theoretician or another has written equations on a piece of paper which suggest that a hypothetical black hole would hypothetically behave in the hypothetical manner which they have hypothesised. Hypothetically, at least. Of course, as they evaporate (black holes, not theoreticians) they lose mass and so by the time the mass has halved the evaporation rate has increased four-fold and the temperature has doubled. To give you an idea of the slowness of this process, the initial Schwarzschild radius of a 10^{12} kg black hole is 10^{-15} m (which, you will recall, is about the size of an atomic nucleus) and the temperature is 10^{11} K, yet for such a black hole to

Physics Forum
by
Bodie Seneta

When I was first drafting the introduction to this issue's Forum, I noted that I was receiving many answers to the problems I wrote about, but never any questions. I wrote that this seemed to be a bit weird, because I would have thought the question would have been the easy part (unless you believe Douglas Adams). I speculated that maybe you didn't know that you can pose questions in these pages as well as answers. Well, you can.

Unfortunately, Murphy was working overtime. The day after I wrote it, of course, I was given a question. Naturally I included it. Others have followed. One of those is included also, with more on the way.

In this issue we will, therefore, delve into the physics of sweating chocolate, apparent contradictions in physics for flautists and still more mysteries from riders of the railways. What can we learn from this? Only that physics is everywhere if you look hard enough. This is either interesting or severely depressing, depending on your point of view. But on with the problems:

Chocolate

Those of you who live away from the coast will have noticed that the nights are now cool enough for dew to appear. You will probably all know that dew forms when the air cools down so much that it no longer can hold all its moisture. The water then condenses onto just about anything.

One evening not long ago, I left some chocolate on my desk, unwrapped (I'm trying to give it up, and not having much luck). When I woke up the next morning, I found that there was no dew on anything in my room, except on the chocolate. Subsequent investigation revealed that on cool clammy evenings, the chocolate was always the first thing to get a film of dew on it. It isn't because the chocolate is fresh out of the fridge, because it never was in it.

This peculiar chocolate property could be put to good use wherever it is necessary to extract water from the atmosphere. Bushwalkers could have an emergency chocolate-powered water generator for camping, and if they ever got really stuck, well, they could always eat the chocolate.

Now can anyone tell me why the chocolate should behave in this way? Does it have an abnormally low heat capacity so that it cools down to the dew point before anything else? Is it hydrophilic, absorbing water during the day and "sweating" it at night when it cools down? Could the water be caused by something else entirely, such as a chemical reaction?

There is a further mystery here. Once when experimenting with the chocolate, I left an overhang of aluminium foil over half of the chocolate, although it was still pretty well exposed. The half that was covered didn't get any dew on it, but the other half did. I have noticed this effect with cars also; if you park on the side of a street on a cold night and there's a tree there, the window on the side of the car under the tree doesn't get any dew on it. Amateur astronomers also use the phenomenom to their advantage - they place "dew caps" (sort of like the sun hoods on video cameras) onto their telescope objectives. The caps don't obstruct vision or the atmosphere at all and appear at first to be totally useless - but they somehow help keep the dew off on chilly winter nights. Can anyone tell me why this should be?

Flutes

I received this letter several weeks ago. It was so beautifully written that I have decided to reprint it exactly. It just goes to show that it's still possible to produce an attractive document

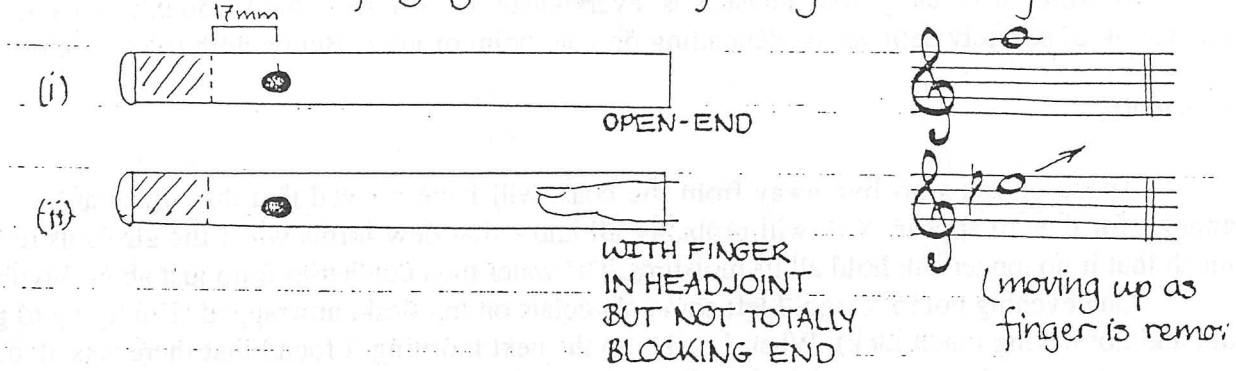
9/V/90

Physics Forum:

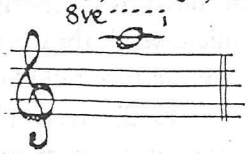
While "physing in musica" one day (ie. doing elementary explorations of the acoustical properties of musical instruments) I encountered a puzzling phenomenum which appeared to contradict everything I vaguely remembered of HSC Physics.

Basic fact (?): long pipes produce low-pitched sounds
short pipes produce high-pitched sounds

Observations while playing on the head-joint of a modern flute:



However pitch is not affected at all when I overblow to the first harmonic. With both (i) & (ii) I got the following pitch:



(ie. sounding an 8ve higher)

Why is this so? NB. the headjoint of a flute is parabolic (well, very slightly) & the above diagrams are not to scale.

Yvonne Frindle B. Mus. II

without a laser printer.

I should add a few notes (no pun intended) for the non-musically oriented readers amongst you - thanks, Sue, for helping me out with this:

The headjoint of a flute is the part you blow across to make sounds. Overblowing is a way of blowing the headjoint so that harmonics of the fundamental frequency are produced; this allows the

playing of notes of higher pitch than would otherwise be possible.

An "8ve" is musicians' shorthand for an octave. A note that is an octave above another note in pitch has twice the frequency of the lower note.

Finally, I don't think the parabolic shape has much to do with it, because Yvonne has demonstrated the effect for me with a baroque flute of quite different design, but with similar results.

I have a vague idea, and I'm pretty sure Dr Ian Johnston *knows,* of the answer to this problem. But I won't do any work on it until the next issue, because I want to give all of you the good old Aussie fair go. If no-one presents a solution, I'll attack it with a microphone, a spectrum analyser, a flute and the flute's owner.

Electrifying Travel with the SRA

I didn't realise train travel was so exciting. David is still getting letters about struggles with hair in train carriages, and now Richard (yes, the editor - *that* Richard - it's all his fault) has come up with a new question.

Sydney's trains are electrically powered by high voltage lines hanging over the rails. The widgets that connect the lines to the train do a pretty good job, but sometimes a connection is momentarily broken and a hot blue spark arcs across the gap. There's nothing unusual about that, but Richard thinks that when it's raining, the sparks are bigger, fatter and in general, more spectacular. Why should this be the case? Does humid air glow more than dry air when it is ionised? Does the presence of water make the contact between train and line somehow better - or somehow worse - and if either of these is so why should it effect the vehemence of the arc? Could it be that when it's raining the sky is darker and the sparks just look brighter?

Well, there you have it. I guess a true physicist would be able to find something to rave about even in a sensory deprivation tank.

Feedback

So far, no-one has attempted to explain why my friend's eyes should have glowed a deep violet at a new year's eve function. I do, however, have plenty of responses to the other problems.

Firstly, the problem of aquamarine water in tropical climates produced this response from Suzanne Godesar (PhysicsII):

"...I also have a suggestion for your <u>water colours</u> problem.

"About two years ago, some may remember, Sydney Harbour changed colour. The colour became more of an aquamarine blue, much lighter and brighter than the usual murkiness. Everyone loved it but were also curious to know what happened, until one day, we found out (I can't remember the source of information). The colour change occurred because, effectively, the temperature of the water had increased.

"A few degrees enabled a different kind of microscopic plankton, an algae, to invade the waters.

"The presence of the plankton caused the water to appear aquamarine blue.

"I think this may well be what happens with latitudes. At the equator where the sea is warmest, more strange algae etc. are able to grow and live. As one moves south these bright creatures cannot survive and hence the sea is darker in the south and presumably also in the north."

One of our workshop technicians was also puzzled by this problem. He stopped by at the

Oceanographic Institute and quizzed the staff there. They said that the blueness was due to the salinity of the water. Warm water can hold more salt than cold water can, and this makes it bluer. They also said that the phytoplankton present in the water affects the colour to some extent. So it looks as if you're both right.

Our technician also thinks he has the answer to the problem about the smooth patches of water on the harbour. He says that while it is true that the water has to be of a particular depth or more to support a given size wave (this is, in fact, why ocean waves break when they reach the shore - the water gets too shallow to support them) the harbour isn't shallow enough to explain the disappearance of the really small ripples.

It's much more likely that the wind is what causes these ripples in the water, and the smooth bits of water are therefore sheltered in some way. Richard (yes, *that* Richard) has also independently told me that when people go out sailing on the harbour, the smooth parts are the ones they avoid, because if they sail into them they get becalmed and they can't get out. Another interesting fact is that mackerel fishermen love these smooth patches, because the fish tend to collect under the boundaries between the rough and the smooth water (this is bizarre - does anyone know why?).

I think that the truth is probably a little more complex; the water currents probably shift the areas of rough and smooth water around a lot. But I have noticed that at marinas in the harbour, boats always leave a "shadow" of smooth water on their leeward sides (you can tell which side that is easily enough - boats at moorings always point into the wind) so it seems that this answer is at least partially correct. If this is indeed the case, maybe architects could use the effect in their wind tunnels to study their designs and prevent potential wind traps from occurring.

Now, since we're still getting replies about trains and hair flow, I'll give David the floor for the next bit:

Yes, and . . . straight to the point. Suzanne Godesar, who helped solve the mystery of the Water Colours, also had a few things to say on the subject of Crowded Trains and Long Hair, from this year's first issue of *Jeremy*.

"From personal experience," writes Suzanne, "I have noticed that the hair is not always sucked out in the same direction as the movement of the train. Because this happens to me frequently I have thought about it and I have a different idea.

"Moving air causes lower pressures. The air outside the train moves rapidly with respect to the inside, therefore there will be lower pressure outside the train and therefore the hair will be pulled outward. [This much was said last issue. DM]

"In which direction the hair is pulled out depends on the speed of the train and where you are standing (whether you are standing upstream or downstream with respect to the wind). The air currents inside the carriage differ with speed. When the train moves slowly, the air comes in, curves around and leaves again (so the direction your hair blows depends on where you stand). If the train moves very fast, the air inside the carriage will rush outward, and air outside will rush straight past (this shows that the faster the train moves, the more violently your hair is dragged out). Anyway, your hair will be pulled out by the pressure difference (if it's long enough!).

"There are also turbulence effects, etc — again depending on where you stand and the speed of the train."

All of this builds on last issue's suggested solution. It seems that the phenomenon is actually a lot more complex than I had imagined. Suzanne's ideas certainly make sense, and I'm not going to argue with the research of an expert (with the long hair to prove it). Well done and thanks for the solution. — DM.

The KitKat Quotes Competition

As the year is half way over it is time to say goodbye to our first semester lecturers and get ready to welcome the new. Those lecturers who have given us so many quotes so far must now retire and anxiously await the results of this semester's quotes before they find out whether or not they have won. The number of foreign quotes is up from many and varied sources. This issue's main contributor is Dick Collins, who no doubt realised that this was the last issue he could get his quotes into for this year. Second year students have been doing themselves proud having sent in most of the Physics quotes. Most quotes by Dick Collins have been submitted by three or four people, so it is a good idea to get the quotes in early if you want to win a box of *Kit Kats* at the end of the year. The other years have been slack so get with it, particularly third year students who could do a lot better than two students contributing quotes. Remember all you have to do to win our prize is submit a quote, and remember foreign quotes are unable to win the prize, but send them in anyway.

Dick Collins:

"I could put this wire up at 10^8 volts in order to do an experiment on a student"

"Its like if you have a big box and in it you put some students. You put the box on the back of a truck and drive the truck to the gap and throw the box into the gap. You're not interested in the shape of the students but only in the number in the box"

"Let's just suppose for fun we reverse the variables"

"You don't dream up coulomb's law by looking at your navel and sweating very hard"

"You shouldn't worry too much about electrets except to know that you can waste a lot of your life working on them"

"Because I'm a physicist, I'll be deliberately vague about what I mean by 'many' "

"Even if you decide to quit engineering and become a greengrocer because there's more money in it, you'll still remember this formula in ten years time. Just ask your greengrocer"

"I realise many of you will become engineers and therefore are not interested in the finer things of life ... like understanding..."

"Engineers get a recipe for building circuits and design brilliant circuits. Physicists on the other hand think about electrons moving in the wire, and their circuits don't work! I should know; I've been there."

"If you want the epsilons and the deltas you'll have to go to Carslaw and get them from the mathematicians"

"I think I can do this without electrocuting myself ... although that would make for an interesting lecture demonstration"

"You look at this formula and then you have a nervous breakdown"

"It's very nice to have a gnome in the corner to correct all my mistakes."

"I can write this as $1/c^2$ because I know what the answer will be"

"We should have brainwashed you sufficiently by now, so that you know that Newton's third law always holds"

"Don't rustle your books; I still have three seconds left!"

"We now have a pretty looking set of equations; it's a shame that they're wrong"

"I threw all my minus signs away"

"I don't like this Lawrence Cram wanting to win the quotes competition"

"This is just some moderately sterile mathematics"

"I'm a para-magnet, you're a para-magnet, we're all para-magnets"

"And this comes from free charges wandering around the joint"

Bill Tango:

"A new topic: Aberrations... I suppose some people regard physics as an aberration"

"I admit this is a handwaving argument. But if it fools you ..."

"If you turn polariod sunglasses through 90^o you can see that they don't work nearly as well ... apart from the fact that you can't hold them on your nose"

Student: "What is a well-corrected lens?'

Bill: "A good lens; not an el-cheapo type which you find in the second-year lab."

"The light is spread out more because of dispersion, which occurs because the light is spread out more"
"Four times four is about fifteen"
"This is for those of you who are turned on by Fourier Transforms"
"Eyeballs have gone out of fashion, they have been replaced by CCD cameras"
"You can aim a dental mirror at a patient without his feeling any discomfort- apart from a first down his throat"
"A sadistic application of this is dental mirrors- those things the dentist aims at your face while he has his fist down your throat"

Brian James:
"You'll notice that the absorption frequencies are not equally spaced. Now why is that? ... I don't really know why. Don't worry about that."
"Now that's a good starting point for this section, so we'll stop here for today"

David McKenzie:
"There you have statistical mechanics in a nutshell - a pretty large nutshell though"
"But the gas molecules don't have registration plates so I can't tell them apart"
"CO is diatomic ... CO_2 is polyatomic ... and $C_4H_{10}O$ is alchohol, I think"
"And we call these solid angle units - steradians. It's sorta like radians on steroids"

Ian Johnston:
"F=ma, Newton's second law. It's the closest thing we've got to God"
"Mathematics is the last refuge of the scoundrel. I apologise for using it"
"This leads to General Relativity and Cosmology. We'll do that tomorrow"
"Everything in this book(Sears, Zemansky & Young) you should know"

FØRƎIGN QUOTES

John McMullen (Pure Maths):
"Conservative fields- they are special elite fields"
"And now were reached the point you thought you were when you started"
"There are two ways of doing this question- this is the way we're not going to do it"
"I know there's a proportion of you who are terrified by this definition"
"I'm putting in this theorem just to make myself feel better"
"I put quotes around things I mean to be vague, things that come up in general conversation"
"The aim of this is to put as many of the words we have used in this course in one paragraph"
"What can you do with this? You stare at it for a while and realize that you have to be clever"
"This is not even intuitive, it's correct"
"When your 64 and you look back, you'll remember you did a second year course on elliposoids. You won't remember anything else"
"That's what the abstraction of mathematics allows you to do- walk into a room blindfolded and still operate"

Karl Wehrhann(Pure Maths):
"You can tell if a physics or biology report is done by a pure mathematician because they use 'primes' instead of 'dots' ... you don't believe me I know."
"I'm glad you all came in late because it's wrong but you won't have written it down"
"You should all have taken the 'Real Variables' course which is given in second semester"

Dr Lai(Pure Maths):
"You can use a silly argument to achieve any result you want"

Roger Eyland(Pure Maths):
"We use 0=1, which most systems of arithmetic don't allow"
"You see how much better it is to have a computer for a friend?"

Terry Gagen(Pure Maths):

"The lecture I gave this morning was the most successful lecture I have every given. I went into the wrong room ... the students didn't tell me until five to twelve"

Bob Howlett(Pure Maths):
"We get U_1 'hot cross bun', U_2 etc ... I'm sorry I didn't introduce the hot-cross-buns before Easter"
"If you can't read this, it's a useful exercise for you to work out what it ought to be"
"I think I should start with a general waffle"

Dennis Winch(Applied Maths):
"It's the sort of thing you look up in a book every 50 years then promptly forget"
"The aim of this is to evaluate integrals without having to lift a finger"
"When you get infinity in this calculation it doesn't mean you're wrong, it just means you're using the wrong formula"
"A hundred years of experience will tell you what value to choose for Co"
"This is a really neat trick that you like to keep up your sleeve for those times when you're waiting on a street corner for someone to come up and ask you what $\int \ln(\cos x)dx$ is"

Howard D'Abrera (Mathematical Statistics):
"There are no stars in Katoomba, you'd have to go a lot further than that. It turns out you have to go to Perth"

R.E. Wass(Geology):
"I can find out exactly to within one million years"
"If you have 100km of rock on top of you, you're under a bit of stress"
"If you had two dinosaurs copulating on Noah's ark, then that's what you'd really call rocking the boat"
"Elephants won't walk on anything that sounds like an elephant walking on an aluminium can"

Chris Dickman(Biology):
"...taking this idea to it's logical conclusion, we can see that the biggest possible land animal would be a giant bone"

Dr Simpson(Electrical Eng.) :
"If you don't believe me you can ask a greengrocer"

Michael Braun(Elec. Eng.):
"We have the usual constant, which is probably different by now."

Dr A.Lacey (Physical Chemistry):
"You come in here rabbitting on like a bunch of chooks"

Peter Treloar (Computer Science):
"Sorry I wasn't here at last weeks tute, I was down in Melbourne being installed as a solicitor. Exactly why I am now back here tutoring in computer science, I don't know"

Jim Donovan(Computer Science)
"There are 1.5 million Australians with reading problems. I think most of them are in CS1"

Alan Chalmers (History and Philosophy of Science):
"We began this course confused and ended up confused on a higher level"

The last quote comes from the English Mathematician **G. H. Hardy** in his essay 'A Mathematician's Apology'. After you have read it you will see why it had to be included.

"It is obvious that irrationals are uninteresting to an engineer, since he is only concerned with approximations and all approximations are rational"

J

PHYSOC

JEREMY

SYDNEY UNIVERSITY PHYSICS SOCIETY

One day quantum physics became quantum mechanics, and we've been suffering the consequences ever since.

One of the Holy Grails of astrophysics is to see a star being formed, but like humans, they do it in the dark.

Instead of using a simple-minded first year approach, we will use a simple-minded second year approach.

I suppose you'd have trouble doing a double slit experiment with a commodore.

An example of negative work is pushing against a charging elephant.

It's an area of current research. In other words, we don't understand any of it.

The CPT theorm says that we can have an anti-me lecturing to an anti-you, writing with my left hand and lecturing backwards. Then there would be no difference to us here now.

He was an engineer, which means he had no credibility whatsoever and no morals.

Referring to Maxwell's equations: "It certainly excited me when I was your age and sexually active."

Now I left you at a temperature of about 3000K last Tuesday and cooling rapidly.

For those of you not studying our first year Physics course, that's all a laser is, a device that you point at someone and they vaporise instantly.

Solving Differential equations is best done by monkeys in front of typewriters.

If you have a bird sitting on a charged wire and it puts one leg on another wire, you very quickly have a fried bird, and that is disturbing.

What I'm going to do is get the answer and then multiply it by 30 so that I get the correct answer.

If someone switched off the sun at its centre, it would be about a million years before we knew about it. Of course, no one can do that, but it's still an interesting thought.

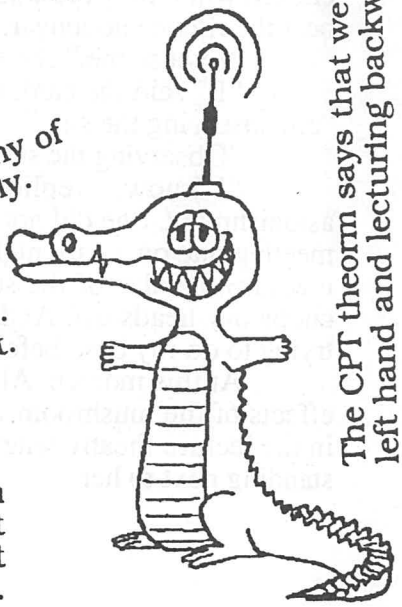
S.M. stands for Statistical Mechanics notSado-Masochism... although some people think they're the same.

Assume the earth has a uniform gravitational field, ie. it is flat, of infinite extent, non rotating and of uniform density.

The theoreticians love plasma instabilities because there are so many of them, its so mathematical, and you can't check them experimentally.

Nobody's going to put swings in the parks that are overdamped. The kids would object.

The mathematician follows an elephant with a bucket and a shovel. The Physicist rides the elephant telling it where to go.



Alice's Adventures in Physics One-derland

by David Mar and Kim Lester.

Chapter Three

Advice From A Caterpillar

Alice blinked and stared at the strange creature before her. "A Paul Walkerpillar? I've never heard of such a thing before, if you don't mind my saying so."

"I'm not surprised," answered the Walkerpillar, "I'm unique. Now," it continued, "You wanted to learn some physics, did you?"

"Well, yes," said Alice, not at all sure of what to make of such a curious character, "but only just a little bit. Not so much that I go peculiar like those people up in the tea room." She shuddered involuntarily at the thought.

"Perhaps you should eat some of the mushroom," said the Walkerpillar, gesturing at its seat.

"Will that help?" asked Alice, wide eyed with wonder.

"Can't hurt," replied the Walkerpillar as it slipped down from the mushroom and began crawling towards the door. In the time that it took Alice to take another dubious glance at the mushroom, the Walkerpillar was out of the door and gone.

"Well," said Alice to herself as she broke off a small piece from the edge of the mushroom, "I don't suppose there could be much harm in just trying a *little* bit . . ." She gave the piece a cautious nibble.

The next moment Alice found herself surrounded by unfamiliar scenery and, when she looked down, found that her shoulders were nowhere in sight: all she could see was an immense length of neck, which seemed to rise like a stalk out of a skylight in the roof of an old looking building that lay far beneath her. The very next thing that she noticed was that it was raining miserably, with the sky an exceedingly dark shade of dismal grey. Not wanting to get her head wet, she snaked her neck so that it was sheltered under some strange sort of construction that was on the roof of a nearby building.

"Hey!" called out a voice, so loud that it startled Alice, "Get away from the dish!"

Alice turned her head and saw that a person was gesturing wildly at her from the shelter of a small and dingy looking hut on the roof of the building. Thinking that it might be a good idea to do as this strange person wanted, but mostly seeing that the hut might be a little dryer than her current shelter, Alice bent her long neck so that her head was inside the hut. She looked at the person in astonishment: he was oblong and flat, with hands and feet at the corners, and ornamented all over with spades. He was obviously most distressed, and turned away from Alice to attend to some *awfully* complex looking piece of equipment (at least it looked that way to Alice) that was being spattered with rain from a hole in the roof of the hut. "Why," thought Alice, "He's a playing card!"

He continued to ignore Alice as he sheltered some more apparatus from the rain with his soggy cardboard body. Alice looked on with great curiosity as the machines hummed, buzzed and clicked while they drew strange looking graphs on miles and miles of paper rolls. Finally Alice could bear the silence no longer.

"Excuse me," she said, "Would you tell me, please, what you are doing?"

"I," said the card, looking up from the blinking lights and waggling meters for just a second, "am observing the sun."

"Observing the sun?" said Alice, "But it's pouring with rain!"

"I know," replied the card, "but you try telling the Lehane that." Alice blinked in astonishment. She did not know what sort of a creature a Lehane was, but did not altogether feel like meeting one on a dark night. "This," continued the card, "is a Third Year lab experiment. We have to measure the size of the sun with the radio dishes out there. If we don't do it properly, the Queen chops our heads off. And not being able to see the sun doesn't serve as an excuse for her. So I'm trying to do my best, before she comes, to —"

At this moment Alice began to feel rather strange, and before long she realised that it was the effects of the mushroom wearing off, because the next thing she knew she was standing once again in the lecture theatre where the Paul Walkerpillar had been. Except that now the White Rabbit was standing next to her.

"Come," said the Rabbit as he pulled Alice back into the hallway, where she was very much surprised to see that a procession was underway. There were a great many people, all shaped like the person on the roof, like playing cards. They were decorated variously with spades, clubs, diamonds and hearts. After all of these came the Knave of Hearts, carrying the King's crown on a crimson velvet cushion — no, Alice looked again and saw that the cushion was actually a book, labelled with the words *Sears, Zermansky and Young* — and, last of all in this grand procession, came the King and Queen of Hearts.

Alice turned to the Rabbit as they joined in the march and asked, "What's going on here?"

"Hush! Hush!" said the Rabbit in a low, hurried tone. He looked anxiously over his shoulder as he spoke, and then raised himself upon tiptoe, put his mouth close to her ear, and whispered, "They're all under sentence of examination. The King, Brian McInnes, and the Queen, Elizabeth Hing, are taking all of these poor first year students to their physics exams."

"Oh dear," whispered back Alice, "the poor souls. Whatever have they done to deserve that?"

"Simply enrolled in physics," the Rabbit whispered in a frightened tone, "Do keep quiet or the Queen will hear you. Then we could really be in trouble."

They reached a large room with many desks laid out in neat rows. "Get to your places!" shouted the Queen in a voice of thunder, and people began running about in all directions, tumbling up against each other: however, they got settled down in a minute or two, and the exam began. In the confusion, Alice and the Rabbit had managed to stay safely behind the King and Queen, or else they might have had to sit the exam as well! Alice was very glad of this fact.

Alice thought she had never seen such a curious exam in her life. The Queen kept on walking around the poor students and looking at their progress; stamping about in a furious passion and shouting "Off with his head!" or "Off with her head!" about once in a minute whenever she saw an answer that displeased her. This behaviour made Alice feel very uneasy, especially when she noticed that the Rabbit had disappeared again.

She was looking about for some way of escape, and wondering whether she could get away without being seen, when she noticed a curious appearance in the air: it puzzled her very much at first, but after watching it a minute or two she made it out to be a grin, and she said to herself, "It's the Cheshire Johnston: now I shall have somebody to talk to."

"And how are you getting on?" said the Johnston, as soon as there was enough mouth for it to speak with.

To Be Continued.

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have evaporated by the present day it would have to have been formed in the Big Bang, some 10^{10} years ago. So we don't really expect to see black holes evaporating all over the place. If we did see one it would be quite spectacular, as the final stages of evaporation are rather hot and explosive, releasing 10^{23} J in less than 0.1 s!

So if you do attempt my suggested experiment and find yourself in the awkward position of actually being a black hole, then you will discover that you are at a temperature of 10^{21} K and will have approximately 10^{-13} s in which to extricate yourself from this predicament before you explosively evaporate. If that doesn't stop you from wanting to be a black hole when you grow up then nothing will.

Having avoided becoming a black hole, you probably shouldn't try keeping one (your best friend, say, who managed to succeed where you had failed) as a pet/door-stop/paperweight/lover/... either, as they really aren't suited to that kind of application. In fact, you should probably avoid all contact with black holes. Next time I will tell you how to recognise different types of black holes, and give you a run-down on how they behave, just in case you find yourself trapped in a lift with one and feel obliged to strike up a conversation on the off chance that it was someone you knew, although if it was it would evaporate before you could clear your throat.

Reference

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BACK TO THE PHYSICS III

STARRING

MICHAEL I. LARGE