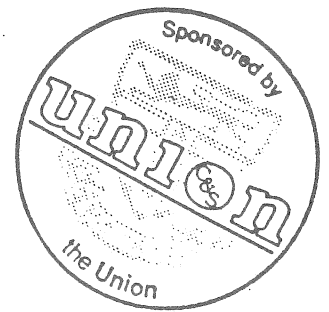


The Official Breakfast Cereal of the University of Sydney Physics Society.

Jeremee-os



BONK! **Twiddle!** **FROB!**



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plus assorted doodles by Daniel.

DISCLAIMER

The editors of this journal will in no way take responsibility for anything contained within. All opinions expressed are those of the authors of the articles.

DISPROTESTATIONER

The freditors of this gherkin kill in no whey steak trotsky fork manyobject untrained legthin. Fall onions orientaled car thunixe ork thematic awfuls on theoretical craftinsectmiserables. For more dong of this exciting fare, visit wonkydongyland, on the far side of the frotran. And also, have a nice puritan.

EDITORIAL

Hail, fellow travellers through the wide brown lands of physics.

We apologise for the delay, but now normal services have been restored... sort of. This was due partly to funding delays, but predominantly to the frenetic lack of interest from you, the viewing audience. Unfortunately, this means you are now absorbing the final *Jeremy* for 1993. However, despair not! Jeremy will be back bright and bouncy in the new year (N.B. with a new editorial team. If you are interested drop a note in the Physics letterbox and attend next years A.G.M.

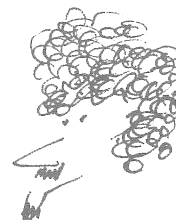
As usual, we request superabundant hoards of quotes, articles, dud theories, President reports and all-encompassing stuff from you plooky faced noctambulists. Remember, if we only receive four pages worth of submissions, you will be blessed with a four page Jeremy... not exactly a Journal (unless you are a member of the Mathematical Society!). Please contribute or we shall be muchly lachrymose.]

Many moist apologies to the singular Ariane Hemming. In the last edition there was an incursion of the forces of evil, resulting in a false impression among the general populace (including her PhD supervisor) that she was not one but many.¹

We were inundated by a letter from an anonymous Callan, probing the mysterious nature of the Prince Nawaf Room, situated opposite the frequently utilized lecture theatre one. Using our boundless guile and intrepid investigative skills we cunningly made inquiries which led to the discovery of the truth. Prince Nawaf was a rich Arabian oil magnate who donated two million dollars to found the Solar Energy Department, and to assist his country's Olympic bid. In return Professor Harry Messel, the then Head of School, named a room in his honour. It is now set aside for Prof, Messel's personal use, and is rumoured to be a sanctuary for emaciated rhododendra in his absence.

So that's all from us. Thanks for all your warm applause and organic raisin.

Matt and



1. We called her
Ariane Hemmings

PHIZ PREZ SEZ.

The exams, thank Einstein are over, as are the holidays. Everyone is happy about the first but not the second. (Oh, please can I do another exam, and this time can you make it really hard. Oh, goody!) A big PHYSOC thank you to all the academics for making our holidays so enjoyable (after all, after the exams, anything seems enjoyable). I hope everyone's results are what they expected and hoped for.

I had a great holiday, reading Physics textbooks (Just a crawl there, I am still hoping for a high distinction.) and I am feeling invigorated for another great semester of physics and more importantly Physoc.

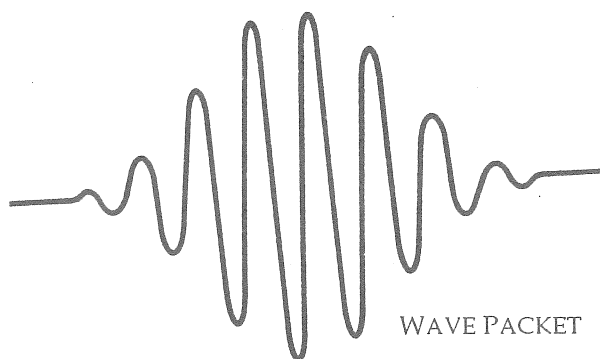
There are many great opportunities for you to get involved in Physoc. You can party those exam blues away at our fabulous lunch and evening parties. (First year students are very welcome. If you enjoy science, this is a great way to meet a whole bunch of interesting people who don't think the Theory of Relativity is "Mum and Dad are my relatives, therefore I am".) You can make good use of your new semester resolution and collect the silly things your lecturers say. (You know the new semester resolution "This time I'm going to go to all my lectures, tutorials, practicals and do all my assignments and study as I go.") You can make good use of your time in lectures and design us a new t-shirt.

Please contribute to Jeremy. The editors are still passing their exams so they must not be spending enough time editing. The treasurer, also, is not sitting in the corner whimpering about having to find money for the next issue of Jeremy. They will accept anything - (even Prez reports. Heck, they ask for the Prez report) - as long as it is somehow linked to Physics or Physoc.

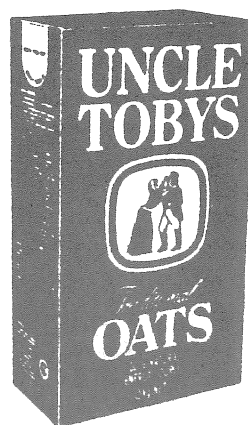
Have a fun semester, with lots of extra-curricular activities. Hope to see you around. "Weird is a relative, not an absolute concept."

Emma Coen. El Prez.

P.S. I wrote this just after I finished my exams. You can tell, can't you.



WAVE PACKET



CEREAL PACKET



CHIP PACKET

COMPETITIONS

So far we have received the grand total of two T-shirt designs, both by the same person. If there is anyone out there in physicsland with any artistic talent, please activate your nibs and give us a fantastic design. There is a prize, honest. We just want a T-shirt with:

- A regenerated croc named Jeremy on it.
- The words 'Jeremy' and 'Physoc'
- Designs for both front and back.

We don't expect finished products or both sides, but it would be appreciated, and the prizes will be distributed among those who enter and work on the designs. We probably need a new croc, so if someone can come up with an original design for a croc we'll use it, and probably reward them.

We actually got some interest in one of our competitions. The prize for uncovering the sentence in the alphabetised president's report was won by Paul Dale, a Physics 1 student. We also got an answer from Chris, in 2nd year. The sentence was: "Handy home hint: Gently rub salt into the fat before roasting pork". Anyway, enjoy the snake, Paul, and don't eat it all at once. Thanks heaps to Elizabeth Hing, the Physoc Mascot and general all-round good person, who actually got the snakes for us.

Some bearded astrophysical dude, who escaped before we could ID him, gave us an idea for another competition: The Inaugural Physics Limerick Competition.

Enter a limerick on any physics subject - whether it be the frivolities of General Relativistic Gauge Transformations, or the aliophagous woaded sexual proclivities of your favourite lecturer. If it isn't too slanderous or boring we'll publish it, and we will make someone who goes to a physoc party read them all out (even the rude ones). There will also be a prize, possibly another

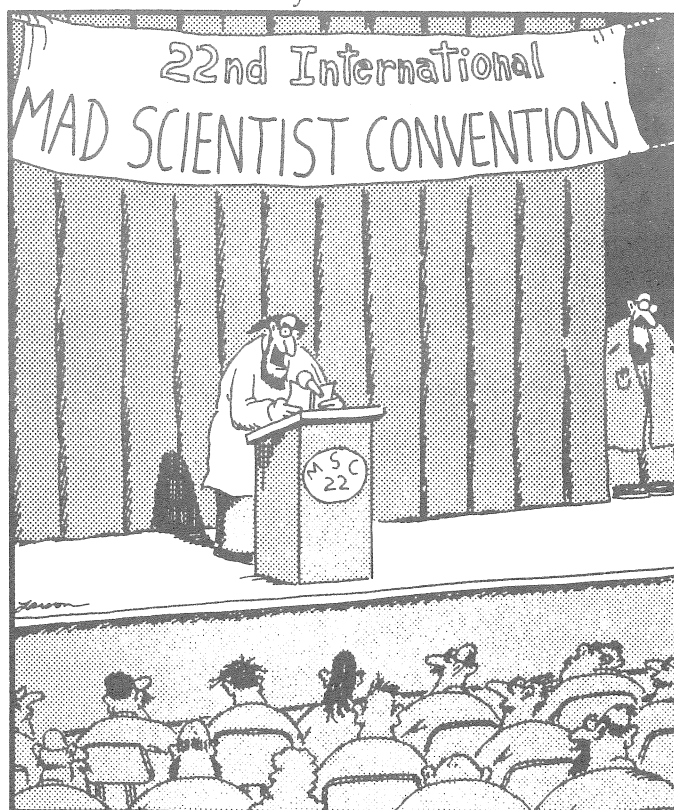
lavish Jelly Snake, or perhaps something even better, if we can get our little editorial hands on it. Here are a few examples:

A fencing instructor named Fisk,
Fighting duels was terribly brisk.
So quick was his action
The Fitzgerald contraction
Foreshortened his foil to a disk.
A. Monger.

Another one, with the first two lines by the bearded dude and the rest by me:

There was was a young physicist called C**m,
Who made passionate love to a Ram.
A subatomic particle
Got caught in his article
And his keyboard got covered in jam.

So anyway, that's all we have in the way of competition news for now. So get down and send us some funky stuff.



"So please welcome our keynote speaker, Professor Melvin Fenwick — the man who, back in 1952, first coined the now common phrase: 'Fools! I'll destroy them all!'"

AT SIXES AND SEVENS WITH THE ULTIMATE QUESTION.

Dr. Murray Batchelor (Senior research fellow, Department of Mathematics, ANU)

Dr. Bruce Henry (Applied Mathematics, University of New South Wales)

Readers who are familiar with Douglas Adams' HitchHikers Guide to the Galaxy series of books will recall that, after seven and a half million years of computation, the computer Deep Thought came up with the number 42 as the ultimate answer to the great mystery of life, the universe and everything. But where does this number come from, and what does it mean?

In Adams' books the Earth itself is a giant computer designed by Deep Thought to find the question (to the ultimate answer). Unfortunately, just as the answer is about to be revealed, the Earth is destroyed by Vogons making way for a new hyperspace bypass and the only question remaining to the ultimate answer embedded in the brain waves of Arthur Dent, the sole Earth survivor, was "What do you get if you multiply six by nine?"

Perhaps it is possible to find some clues by looking back at some of the important instances of the ultimate answer that have already occurred. We can begin by noting that the ultimate answer of 42 is a common link between the founding fathers of science: Galileo Galilei and Isaac Newton. The former died and the latter was born in 1642. René Descartes's major Philosophical work *Principia Philosophia* was also essentially completed in 1642 (he delayed publication until the work was translated into Latin "to help it gain a better reputation among schoolmen"). In the section on "the principle of human knowledge" we find: "Principle 6: We have free will... Principle 7: I am thinking, therefore I exist. Principle 42: Although we do not want to go wrong,

nevertheless we go wrong by our own will."

The freedom expressed by Descartes philosophy is at sixes and sevens with the determinism that emerged from the new scientific enquiry in the 18th century. In the deterministic view, science is an omniscient phropheet and all great mysteries are tractable-at least in principle.

One of the most spectacular successes of the deterministic scientific approach to revealing mysteries of the Universe was the accurate prediction by Edmund Halley of the return of a comet that both he and Newton observed overhead. They both died before the comet returned as predicted. Halley died in 1742.

Such successes inevitable led to greater quests. Albert Einstein, who was awarded a Nobel prize at the age of 42, wanted to "know how God created the world". In the realms of theoretical physics this burning problem became manifest in the search for a unified theory of everything. According to Stephen Hawking (born 1942) this may be achieved "by the end of the century".

The ultimate answer is important to science in other ways too. For example, Richard Feynmann (who received his PhD in 1942) used to art of numerology to come up with some convincing ultimate questions: "The ratio of the gravitational attraction to electric repulsion is given by a number with 42 digits trailing off. Now therein lies a very deep mystery. Where could such a tremendous number come from? ...if you want a large number why not take the diameter of the Universe to the

diameter of a proton- amazingly enough it is also a number with 42 digits."

The number 42 also occurs in Darwin's *On the Origin of Species*: "In 1842 I first allowed myself the satisfaction of writing myself a very brief abstract of my theory." The ultimate answer also appears in the history of rock music: Paul McCartney, Brian Wilson and Jimmy Hendrix were born in 1942. Elvis died at the age of 42.

To find some of the most revelatory insights we have to look in *Alice's Adventures in Wonderland*. To begin with, consider Alice's fall: "I wonder if I shall fall right through the Earth! ...Please Ma'am, is this New Zealand or Australia?" If we assume both Alice and the Earth to be uniformly dense and also neglect the effects of friction, the time taken for Alice's fall can be readily calculated. The answer is 42 minutes.



"Whoa! Whoa! C'mon, you guys! This is just a friendly game of cards — ease up on those acid-filled beakers."

But the most significant incidence of the ultimate answer in Alice's adventures is that it is the key to solving the ultimate riddle as to who Alice is. Just after her fall she muses: "Who in the world am I? Ah, that's the great puzzle! ...I'll try if I know all the thing I used to know. Let me see: four times five are twelve; and four times six is thirteen, and four times seven is - oh dear! I shall never get to twenty at that rate!"

One of the scholars of *Alice in Wonderland*, A. L. Taylor, suggests in his book *The White Knight* that the way to make sense of Alice's multiplications is to start is base 18 and then add three to the base each time one is added to the multiplier: $4 \times 5 = 12_{18}$, $4 \times 6 = 13_{21}$, $4 \times 7 = 14_{24}$... $4 \times 12 = 19_{39}$. Each time the multiplier is increased by one, so is the product. But it all breaks down if Alice tries to multiply 4×13 (in base 42). The answer is not 20, which leaves Alice at sixes and sevens (whether added to give 13 or multiplied to give 42).

Finally we turn to the new theory of chaos to provide a solution. The fundamentals of chaos were described in 1942 by Wallace Stevens in his poem *Connoisseur of Chaos*:

" A. A violent order is disorder; and
B. A great disorder is an order. These two things are one."

The mathematical key to the harmony of order within disorder in chaos in the generation of randomness, According to law 42 in the rules of cricket, the umpire must inspect the ball "frequently, but irregularly".

Clearly the umpire could employ a random source based on coin tosses to decide the timing of the inspection, but this might be time consuming. Alternatively, the umpire could use a deterministic algorithm to introduce randomness. For example, the ball could be inspected at the start of the game and then after x_0 hours

have elapsed, where

$$x_0 = 0.00595238 \times \text{umpires age in years.}$$

The successive time intervals $x_1, x_2 \dots$ (expressed as a fraction of an hour) can now be determined in a serial fashion from the simple algorithm

$$x_{n+1} = 4x_n(1-x_n).$$

The frequency of the inspection would be as random as any scheme bases on tossing a coin, unless the umpire is 42 years of age.

A trendy new game that has emerged from chaos is that of trying to deduce whether irregular behaviour (such as fluctuations in the value of the Australian dollar compared to the British pound) has been generated by a deterministic or a random algorithm. Measurements of the time series provide a number of data points, N , that can be geometrically analysed. If the time series was generated by a deterministic algorithm, then a geometrical pattern called a strange attractor will be revealed.

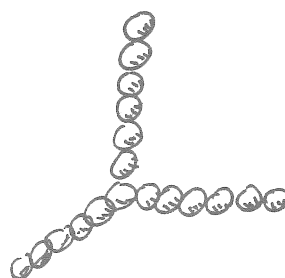
One characteristic of the strange attractor is its dimension, D , which can be readily calculated using the Grassberger-Procaccia algorithm. According to recent work by French theoretical physicists Jean Pierre Eckmann and David Ruelle, the value obtained for D are ultimately limited by the number of data points any any value $D < 2.\log N$ should be regarded as revealing the limit of the data set rather than revealing a true property of the attractor.

Ruelle described the results of this research in a paper "Deterministic Chaos: The Science and Fiction", which he delivered to the first conference on Chaos in Australia. At the conclusion, Ruelle raised the possibility that this is the upper bound that the computer Deep Thought has discovered: "I think that what happened is this. The supercomputer took a very long

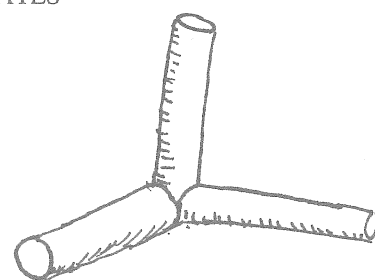
time series describing all it knew about 'life, the universe and everything' and computed the correlation dimension of the corresponding dynamics, using the Grassberger-Procaccia algorithm. This time series had a length somewhat large than 10^{21} . And you can imagine what happened: after many years computation the answer came: dimension $\sim 2 \log N \sim 42$."

But after sifting through the evidence, we suggest our own solution to the ultimate answer to the ultimate question imprinted in Dent's brain: "What do you get when you multiply six by nine?" We see that, like Alice, the sole Earth survivor was at sixes and sevens, and the answer is 42, but in base 13. Or should we wait for 2042?

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SPHERICAL CO-ORDINATES



CYLINDRICAL CO-ORDINATES



CO-ORDINATE AXES

THE KIT KAT QUOTES COMPETITION

NEAR QUOTES

DR. BILL TANGO

"This quantity is not very useful for practical applications, so those of you who are engineers probably have little interest in it."

"We could make a current if we had a room full of trained ants carrying electrons."

DR. BRIAN JAMES

"They are orthogonal to each other at right angles."

"You're probably more familiar with this than I am, because I've forgotten it."

"...our old friend, the diffraction pattern of a single slit."

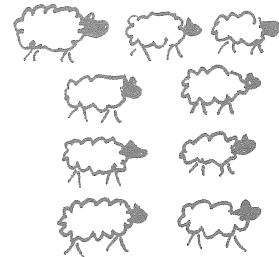
DR. ROSS MCPHEDRAN

"Theoreticians like me don't admit to dropping a minus sign. We say we work in the Melrose gauge:
 $+1 = -1 = i$.

Very useful!"

Ross: "The theory of Bremsstrahlung is a bit like peeling an onion..."

Student: "It makes you cry?"



FAR QUOTES

DR. CHRIS "CLEVER" COSGROVE (APPLIED MATHS)

"Mass is the number of kilograms its got."

ASSOCIATE PROF. TERRY GAGEN (PURE MATHEMATICS)

"This is a real physical interpretation of a problem in linear algebra."

SHEPERDS PI

DAVID EASDOWN (PURE MATHS)

"If you had enough time you could go on forever"

DR. TZEE-CHAR KUO (PURE MATHS)

"So, this is the answer...see, I'm too fast for you. [Class indicates an error is present] What, you dare challenge me? [Class indicates yes] No, I know you're not that smart [studies board] Oh no, I'm not that smart either. Hmm, must be due to old age. It doesn't matter if I make all these mistakes, because I'm not going to be examined any more."

MICK HOLLINS (COMPUTER SCIENCE 3 TUTOR)

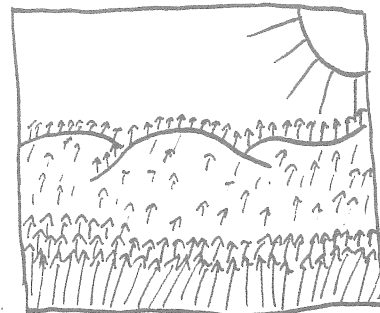
"How do I know? I hate this stuff!"

DUMB TEXT BOOK DEFINITIONS

(Submit your own...win fabulous prizes)

Diffraction The failure of light to travel in straight lines.
Jenkins and White, Fundamentals of Optics, p288

Propagating medium The stuff that does the waving.
D.J. Griffith, Introduction to Electrodynamics, p448





A GUIDE TO PHYSICS

Derek Abrahams,
Emeritus Tutor,
Department of Theoretical Astrology,
University of Northern Antarctica.

1. Introduction

Yet to be written.

2. Classical Physics

2.1 Column Vector

There are three types of column vector: Doric, Ionic and Covalent.

2.2 Grammar of Physics

(an example)

substantive : chaos

	masculine	feminine	neuter
accusative	K ⁺	K ⁻	K ^o

3. Virtual Physics

4. Fundamentals of Physics

4.1 The Meaning of Life

13.6eV, NOT 42 (q.v.) as has previously been quoted in this journal.

4.2 42

Previously thought to be the meaning of life, it may be derived from the true value by using the Ersatz formula:

$$42 = \frac{13.6c}{\cos(13.6^\circ)}$$

where c is the speed of light in dm/ns

5. Botanic and Mathematical Tools for Physics

5.1 Log

The inverse procedure to exponentiation.

5.2 Branch

Applied, Astronomy, Astrophysics, High Energy, Optics, Theoretical.

5.3 Leaf

Vot vun does at ze end of ze lekture.

5.4 Twig

What one does not do to the course material until after the exam.

5.5 Complex Numbers

Numbers involving $i = \sqrt{-1}$. Do NOT confuse complex mathematics with complicated mathematics -- although both are extremely common in Physics.

5.6 Scaling Factors:

$$\frac{1}{4\pi\epsilon_0}, \frac{1}{2\pi}$$

Factors omitted in some textbooks in order to confuse students. Prior to first year, when it is simplified, $\frac{1}{4\pi\epsilon_0}$ is called k

6. Optics

6.1 Radiation

Notes on an overhead projector.

6.2 Absorption

What *theoretically*, happens to the information thereon.

6.3 Line Blanketing

The point of (quantum) physics lectures will be buried under either

- details, or
- mathematics

6.4 Poynting Vector

Along with the *Stress Tensor*, a tautology.¹

6.5 Pfund Series

The rigmarole necessary for obtaining research grants.

7. General and Modern Physics

7.1 Binding Energy

What keeps Sears, Zemansky and Young² from decaying into loose sheets.

7.2 Fluid Mechanics

Plumbers.

7.3 Frame of Reference

The margin of the CRC handbook.

7.4 Slide Rule

When lecturers show Pretty Pictures (e.g. astronomy lectures), more students will attend the lecture.

7.5 Plan(c)k's Law

The plan(c)ks which make up benches in Physics lecture rooms will wobble to an uncertainty of $10^{35} \times \frac{h}{2\pi}$ metres.

7.6 Bracket(t)

- (i) A series of lines in the H spectrum.
- (ii) The piece of metal which holds the spectrometer in (i).

7.7 Frequency Modulation

You will have no assignments for three weeks, followed by six due on the next Monday.

7.8 Nuclear Forces

FORCE	BOSON
Weak Force	$W^\pm, Z^0$
Strong Force	Gluon
Semi-strong Force	Paste-on
Fly-spray Force	Baygon
Quilt Force	Futon
Milk Force	Carton
Cheese Force	Par-meson

¹ This is a classical result. See, for example, old issues of Jeremy.

² For first year students, Sears and Zemansky have been removed from the 8th edition -- they were there before. [This may have something to do with their deaths .. Ed] For Professors, Sears and Zemansky have been revised by Young for the past few editions.

PHYSICS FORUM

Sue Byleveld

It's been a while since Physics Forum appeared in this illustrious journal. The scary thing is that there are many of you out there in Physics Land suffering through *yet another* course in electromagnetism who have never had the relief of reading this column. What's so scary about that? Well, it's not just that you may find yourself listening to a lecturer get excited about Maxwell's equations in differential form, but it's simply that I do remember reading Physics Forum in *Jeremy*. I get the feeling I've been around this place an awfully long time!

What is this Physics Forum anyway? This column, as far as I am aware, was dreamt up by our one time Physoc mascot and postgrad extraordinaire, Bodie Seneta who decided about a year ago that he'd definitely been around this place too long and promptly left. The purpose of this column is to address those queer and amazing effects we notice in our everyday life that make us ask; "How on earth is that happening??? Or am I just hallucinating as a result of drinking the amazing bubbling punch at the last Physoc party?!" What sort of effects am I talking about? Well to give you a feel for the sort of thing I'll be writing about in this column, here's an excerpt from *Jeremy* Vol. 5 no. 4, where Bodie is talking about a problem about frisbees:

"When the square dries out, students like to play Ultimate Frisbee on it. Many of them are Physics students In Ultimate Frisbee, a player who is in a tight spot may throw a frisbee over the head of a blocking opponent. The throw is similar to an ordinary frisbee throw, except that the frisbee (and it's initial path) lie in a vertical plane when it is thrown. When this happens the frisbee invariably flips upside down. I'd like to know why it flips over onto it's back. Experience with frisbee throwing tells me that a frisbee is generally much better behaved when it is the right way up. Why, then, should the frisbee decide it likes to be upside down when it is given the choice? Why, for that matter, doesn't it just flip upside down once you throw it in the conventional manner? "

So, you get the idea? Good! Anything, everything that's puzzling or interesting, odd or unusual that you notice is ideal material for this column. So send it to me via the Physoc Mailbox. Now I'd hate you all to worry so much about the solution to the frisbee problem that you can't sleep at night and forget to do your electromagnetism assignments, so I'll include the answer in the next issue of *Jeremy*.

As an incentive (well lets be honest here, it's really a bribe), to get you all involved, sending me puzzles and possible solutions, we will be offering prizes to those of you who participate. Anyone sending me questions or answers will receive free entrance to the next Physoc party.

Now on to this issue's puzzles. Two very keen students have already sent me some problems to get on with. Happy puzzling!

Springs and Things

This one comes from a chemistry student, Jonathon Arthur. Can you believe that? A chemistry student! Now we can't let ourselves be shown up by the chemists can we? So all you physics students out there, start getting your ideas together and send me something. In the meantime, our friendly chemist writes:

"Imagine I take a spring which I proceed to compress thus storing a certain amount of potential energy within the spring. While the spring is compressed I set it in some material which maintains the compression e.g. concrete or wax. The ends of the spring remain still exposed. I now immerse the entire system in a large beaker of 10M Hydrochloric acid until the spring is entirely dissolved. Now remembering that energy cannot be created or destroyed - Where has the potential energy stored in the spring gone?

The only answer I have is that the energy goes into increased heat when the spring is dissolved i.e. dissolving two springs of the same mass in the same amount of acid will give a measurably different temperature change if one of the springs is compressed. However I am not sure if this is true."

Well there you have it. A chemist asking physics questions, where will it end? But then again, we all know from one of Paul Walker's quotes from an earlier *Jeremy* that "chemistry is just the physics of the outer electron", so maybe it isn't all that surprising after all. Any ideas anybody? Anyone feel like playing with 10M Hydrochloric acid and trying the experiment for themselves?

Magnifying Glasses and the Second Law

I am happy to say that the next problem comes from a physicist. The puzzle and paradox fan, Alan Roy. His problem is one which appears to violate the second law of thermodynamics. Now we all know the second law is ultimately true. If not from the endless thermo courses we have to sit through, then simply from the mess which inevitably accumulates on our desks and in our rooms no matter how hard we try to keep them tidy. So what is the problem here? Is the second law true after all? Will we suddenly find our rooms miraculously clean when we go home today? Or is there a solution to this problem of Alan's?

"Take two black body radiators. Let the hole in one cavity have twice the area of that in the other, and point the two holes at each other through a magnifying glass. Let the two cavities come to equilibrium, at which time the power radiated from the area $2A$ of one cavity into the other cavity equals the power radiated from the area A of the other cavity back into the first. This means that although the cavities are at equilibrium, each radiates a different amount of power per unit area, so they are at different temperatures, which violates the second law of thermodynamics."

I hope you enjoyed Physics Forum in this issue of *Jeremy*. Please write to me via the Physoc Mailbox, and remember I'm not just looking for answers, but also new questions. I look forward to hearing from you. Don't forget those prizes!

Jeremy (dzeri'mi) *n.* 1. The annoying trend towards adorning T-shirts with completely irrelevant and often fallacious dictionary definitions as a vehicle for propaganda. 2. The Official Journal of the University of Sydney Physics Society.

T-Shirt design inspired by a need to cultivate interest in this competition, and to fill up excess space.