

CRESS: our eye on the universe

By Paul Stuart
We are all in the gutter, but some of us are looking at the stars.
 —Oscar Wilde

York is not generally thought of as a window on the universe, but it's the home of the Centre for Research in Experimental Space Science (CRESS), the function of which is to keep an eye on what's going on ... out there.

The centre, staffed by professors Sun Kwok, Chris Purton and Stanley Jeffers boasts 24 and 12 inch telescopes, and an array of sophisticated equipment. Recently it has made an important contribution to astronomy, with a theory on the death of stars.

Kwok and Purton, working with Prof. M. Fitzgerald of the University of Waterloo have come up with the "Inter-acting Stellar Wind Model of the Origin of Planetary Nebulae." This could change the shape of astronomical theory on the subject which has held sway for decades.

The first point to be cleared up, is that planetary nebulae have nothing to do with planets. They were mistaken for planets by an earlier generation of astronomers, but are really luminous, gaseous rings. However as happened with the West Indies, the misnomer stuck.

The get an idea of what the theory is all about, it will help to look ahead a few eons into the future of a run-of-the-mill star — our sun.

The principal source of the sun's energy is hydrogen fusion. But after billions of years of nuclear reactions which fuse hydrogen nuclei into helium at a ratio of four-to-one, the sun will balloon enormously into a "red giant." The outer layers of the sun will cool to a tepid 3,000 degrees Celsius. The inner core will contract and grow hotter with helium fusion and eventually reach a temperature of about 50,000,000 degrees Celsius. For some time astronomers have known that red giants eventually become planetary nebulae, but the way in which this transformation was supposed to have taken place was never clearly spelt out.

Traditionally astronomers held that a red giant's outer layers or "red envelope" were explosively thrust into space. But they could never explain the explosion.

Kwok, Purton and Fitzgerald on the other hand, contend that the mass of a red giant is gently wafted into space in a gradual process lasting between 100,000 and one-million years.

This takes place through the actions of stellar winds. Both the inner core of a red giant and the red envelope have stellar winds. The envelope's wind is caused by radiation pressure on dust in its (rather unbreathable) atmosphere. The wind on the inner core is the effect of radiation acting directly on gas.

The wind from the inner core overtakes the outer wind, and their

collision achieves a "snow-plow" effect which compresses the stellar gases into a dense shell of "young, low-mass planetary nebula."

Incidentally, when the sun turns into a red giant, it will extend to somewhere between the Earth and Mars. The fate of Earth and any of our unlucky descendants who are still hanging around, will be vapourisation in a red giant. The atoms involved will find a temporary repose in a planetary nebula which will exist for from 10,000 to 20,000 years. And then.....

"Think of the number of atoms in a human body," said Purton recently, while he relaxed in his Petrie Science building office.

"Some of them are bound to end up in another planet in six or seven billion years."

Meanwhile, Purton and Kwok are waiting for their theory to get a hearing in the world of science — which is already filled with the clamour of theoreticians competing for attention.

"It's a matter of getting people to read it," remarked Purton, adding, "We're quite excited about this."

The new theory made its debut February 1, in the prestigious *Astrophysical Journal* of the American Astronomical Society. It rested on years of solid observational work.

The gathering of empirical data is a never-ending process at CRESS. It has been made considerably more effective by instrumentation developed by Prof. Stanley Jeffers. Jeffers came to York in 1969 and was assigned the task of counteracting the brightness of the Downview sky, glowing from the light of the big city and blotting out the stars.

Over the years he developed a "photo-electronic imaging device," or "image intensifier," which, as he puts it, "enables you to subtract the signal you get from the sky from the light of the stars." When the improved optical telescope is combined with a radio telescope (like the one at Algonquin Park) microwave, infra-red and x-ray devices, astronomers can "see" far more of the universe than is revealed in the



CRESS prof Stanley Jeffers at the 12" telescope.

visible spectrum.

Most astronomers believe that with the aid of micro-waves they can "hear" all the way back to the Big Bang — the origin of the universe.

As Jeffers tells it:

"The party line on that is that originally there was an enormous cloud of hydrogen. Every atom in it was gravitationally attracting every other atom. This collapsed the cloud and in doing so it got so hot, nuclear reactions were initiated..."

One thing led to another and the cloud suffered a vast explosion: The Big Bang. The theory has it that the galaxies were formed out of pieces of the mass which were exploded in what author Stephen Weinberg calls "the first three seconds."

An interesting thing about the Big

Bang, is that it shows astronomers and astro-physicists have taken over what used to be a function of religion and mythology: the explanation of the origin of the universe.

Asked if contemplation of the stellar reaches has gotten many astronomers interested in religion, Jeffers replied:

"I don't know. I can only speak for myself. You see, from my point of view, we have to believe the laws of physics apply everywhere in the universe."

"My attitude towards religion is summed up by what Voltaire or LaPlace said: 'I have no need of that hypothesis.'"

And then there's the questions which fascinate everyone: Are we alone?

Mightn't someone out there be listening to our radio and tv broadcasts?

"That raises some interesting questions," said Purton. "Like who's listening to us? And why would they be listening to us now?"

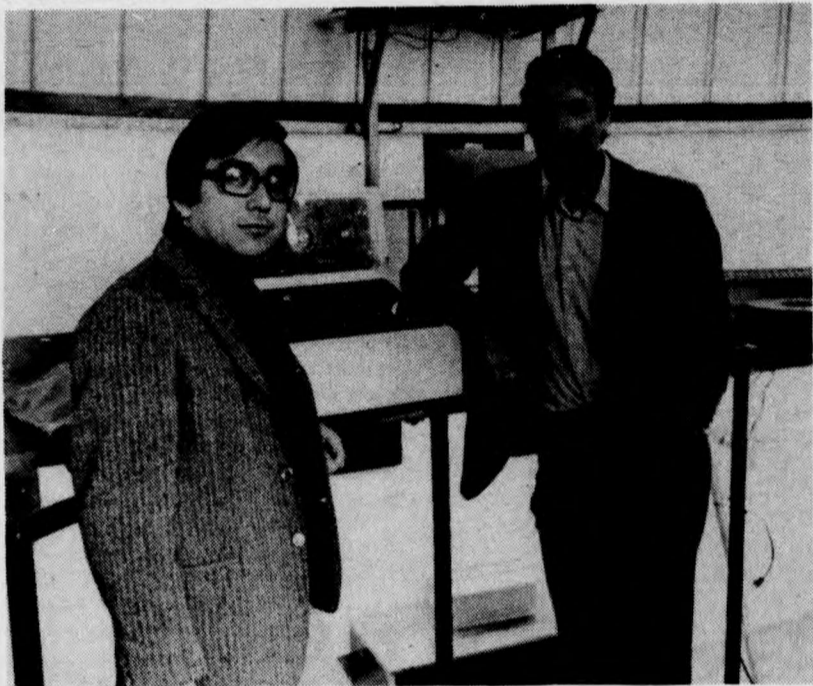
As Sun Kwok explained it, in view of the fact that we've had radio and television for only a few decades, the odds are not good that other civilizations in an inconceivably vast universe have managed to pick us up already. "I don't believe we've truly had a close encounter of the third kind," he said.

Apart from having our curiosity titillated, what do the rest of us gain from astronomical research? Said Jeffers:

"If you think historically, in medieval times people were very disturbed every time there was an eclipse. So scientists have helped in that regard."

"There is a high degree of intellectual curiosity involved, but I couldn't justify it in terms other than that. I can't tell you I'm going to develop an instrument that will do wonders for the Canadian economy, though some people might approach it that way."

In other words CRESS exists to add to the store of human knowledge. In this day and age it's nice to know there are things like exist.



CRESS astronomers Sun Kwok and Chris Purton, fathers of a revolutionary new theory on the deaths of stars.

No free meals in store for 78-79 at this university

By Paul Kellogg

York University should operate at a deficit next year, according to a brief written by the York University Anti-Cutbacks Coalition to be submitted to York's Board of Governors on Monday.

The brief presents the position of the coalition on the budget crisis facing the university. The administration intends at present to balance its budget. That means slashing \$4-million from next year's budget and the dropping of dozens of courses and hundreds of part-time faculty.

"None of us — students, staff, or faculty — expect a future free of difficulties and restraints" the brief states.

But "it is vital that whatever resources we have, we manage in such a way as to maximize the portion available for teachers, books, laboratories, and other academic services, without neglecting the essential support services that keep the university functioning. Whatever Mr. Parrott may imply, no one at York University is asking for a free lunch," the brief continues.

"What we are asking for, what we are demanding, makes so much sense that the alternative can be dismissed as nonsense. It is that the government of Ontario be constrained to preserve the system of higher education which has been built up over the past two decades with such great expenditures of talent, energy, and money."

The brief calls upon the Board to "join us, and to display public leadership, in the following course of action:

1. To present intelligently and forcefully to the government and to public opinion and, in particular to the essential constituencies of York University, the case for York University and higher education in Ontario.
2. To accept a policy of deficit financing when, as is now the case, the alternative is the destruction of the quality of education at York.
3. To make every effort to maximize our non-government voluntary sources of income without increasing student tuition."

The brief will be presented this Monday at the Board's monthly meeting at 6 p.m. in the Board Senate Chambers at Glendon College. The coalition hopes that interested York students, faculty and staff will attend to let the Board know their position on the budget crisis and the cutbacks.



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