CAN YOU

Believe it?

WITH ASSOCIATE PROFESSOR DEREK LEINWEBER

Explosive origins

Our past, and future, can be found in the stars.

HAVE you ever wondered where you come from? We're not talking about the birds and the bees, but the very stuff we are made of.

There are 116 chemical elements that compose our universe. They are the same atoms that make up your body, your house, this planet, that burn in the sun itself.

But where did they come from? Were they always here? Or were they manufactured in some form of cosmic alchemy?

The answer lies in the stars.

Within the first thousandth of a second following the Big Bang, all the matter of the universe was in the form of a hot gas of charged elementary particles. Shortly after, the first protons and neutrons formed.

But it wasn't for another 300,000 years that the first atoms formed. And these were only the two lightest elements: hydrogen and helium. That's pretty much it. It would take another billion years before the next element of the periodic table could be formed.

During this time, gravitational attraction was pulling matter together to form the first stars.

Primordial hydrogen and helium atoms were drawn together to a point where their cores fused to form new elements - a process which released energy as light and solar wind. This cosmic fusion process is the origin of many of the elements on the periodic table – elements essential to life.

The calcium in our bones and the iron in our blood were baked in the cores of ancestral stars. And we can thank them for elements like carbon, nitrogen and oxygen. But the buildup of complex atomic nuclei comes to a dead halt with the 26th element of the 116-element periodic table, iron.

And there are many more elements in the world around us, and in ourselves. These were forged in the cataclysmic deaths of stars.

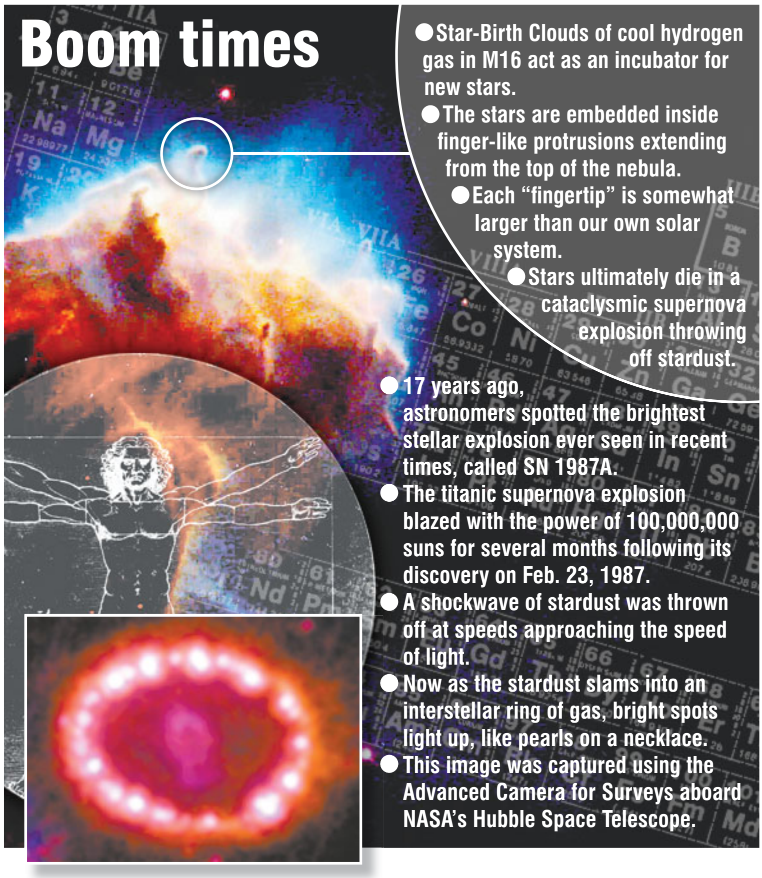
When a star dies and goes supernova, the enormous compression at its core creates new elements, including all our precious metals of gold, silver and platinum. Heavy elements including lead and uranium appear during the dramatic eruption. But how do these elements suddenly appear?

This is the subject of intensive scientific investigation. Scientists, such as those at the University of Adelaide's Special Research Centre for the Subatomic Structure of Matter (CSSM), use information gathered from massive particle accelerators that smash together elements.

It all takes us a step closer to understanding the structure of matter, and what is going on when a supernova ejects its mix of cinders – a cocktail that we know of as the Periodic Table. All these cinders come together to form new stars and planets – such as our Earth.

Our planet is rich in these elements because the Earth is stardust. We, too, are stardust.

Derek Leinweber is an Associate Professor of Physics at the University of Adelaide. His research in subatomic physics uses supercomputers to explore interactions between the elementary particles that compose the protons and neutrons at the heart of the atom.



Elementary, my dear Watson . . .

- **Hydrogen is 13 billion years old – almost as old as the universe itself.**
- **Hydrogen is the most basic element, composed of one electron, one proton and possibly one or two neutrons.**
- **The most ancient stars contain very little metal. The oldest were formed from primordial hydrogen and helium.**
- **Metals are part of the "pollution" emitted by stars, and eventually recycled as part of new stars and planets.**