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HEADLINE: Science: The end is nigh ... but not for a while

BYLINE: Charles Arthur

BODY:
The **universe** is getting bigger - and nothing is ever, ever going to stop it. It's good news, as long as you don't mind the lights going out 100 billion years from now, says Charles Arthur.

The end is not nigh. According to scientists' latest findings, the **universe** is going to continue **expanding** unstoppably in the same way that it began from the Big Bang about 15 billion years ago.

Why? Because there's not enough mass in creation to stop it.

The finding that the "Big Bang" is not going to be followed by a "Big Crunch", in which the universe reverses itself and starts shrinking again, was reached by five teams of astronomers which each used different techniques to measure the mass of the universe.

The result means, according to Ruth Daly, a Princeton University astronomer, that "it is quite clear now that the universe will expand forever."

This is good news in most respects, though it has to be tempered by one point. In about 100 billion years, entropy will have won its constant battle with energy and matter, and all the stars will have burnt out: it will be cold and dark, "with nothing left but rocks," said Ms Daly.

If the universe contained sufficient mass, then the force of gravity would eventually slow and then reverse the outward expansion of the boundaries of space and time begun by the Big Bang - much like a ball rolling into a U-shaped valley will roll up the sides, but in time falls downwards again. Some scientists have theorised that the universe could have gone through endless cycles of "bangs" and "crunches".

For years, astronomers have argued over this point, which in their terminology, is whether the universe is "closed", and so will crunch, or "open" and will always expand. (A third possibility exists: that it is perfectly balanced between both states. But the chances of that would be like flipping a colossal coin and having it land on a razor-sharp edge.)

The study teams were based at Princeton, Yale, the Lawrence Berkeley National Laboratory and the Harvard-Smithsonian Astrophysics Institute, and reported their findings to the American Astronomical Society meeting.

Neta Bahcall, working with a second Princeton team, said her studies of the largest structures in the universe - immense clusters of hundreds of galaxies, each with billions of stars - show the universe is too lightweight ever to "crunch": "it has only about 20 percent of the mass needed to close," she said.

Peter Garnavich of the Harvard-Smithsonian Center for Astrophysics, Saul Perlmutter of the Lawrence Berkeley National Laboratory and Bradley Schaefer of Yale studied supernovae, which are exploding stars, to measure the rate of expansion of the universe.

By looking very, very deep into the universe, the astronomers were able to measure the rate of expansion early in the history of the cosmos.

Speed of the expansion over time is essential for estimating the density of matter in the universe and, thus, determining if the expansion will continue. Mr Garnavich said his team is at least 95 percent certain now that the "the density of matter is insufficient to halt the expansion of the universe."

Some of the supernovae studied by the astronomers are the farthest stellar explosions ever sighted.

Ms Daly used still another system, measuring the distance and motion of radio "hot spots", intense sources of natural radio signals that are emitted from very hot stars.

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