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Does the universe contain an infinite number of Kevin Rudds?

The year 2009 is the international year of astronomy. To mark the occasion, the Astronomical Society of Australia recruited a small group of media-friendly astronomers to give lectures around Australia to spread the wonders of astronomy to the average punter, tall poppies and tax-paying beer drinkers. For this demographic, I chose to lecture on the controversial question, "Is there more than one universe?" The answer, I think, is probably yes.

"That can't be right! If the universe is everything there is, what possible sense does it make to talk about other universes? Where would they be? How could they exist outside everything? The whole idea seems crazy and unscientific. And besides, how could you possibly test such an idea?" Despite these objections, the idea of a multiverse, in some form or other, is being taken seriously by an increasing number of scientists, led by a vanguard of theoretical cosmologists (e.g. Stephen Weinberg, Alex Vilenkin). The least controversial version of the multiverse idea is based on the idea that our finite observable universe is embedded in a (possibly) infinite universe. Because of the finite speed of light and the 13.7 billion-year age of the universe, light can only travel a certain distance during the 13.7 billion years since the Big Bang. The educated but naïve reader will estimate this distance to be 13.7 billion light years. This would be true if the universe were not expanding. In an expanding universe we have to include a correction factor for the expansion of the distance between the light and its point of origin. When this is done, our observable universe (the volume of the universe that we can see) has a radius of about 47 billion light years. If the entire universe is spatially infinite, there are an infinite number of such volumes.

Recent observations of the cosmic microwave background suggest that the geometry of the universe is not spherical and finite, but rather flat and infinite. An analogy might help to explain how this works. Suppose you are stranded in a boat on the open ocean. You have a very long and straight ruler. You hold it up to the horizon and see that the horizon has a small curvature to it. From this curvature you can deduce the finite size of the Earth. When we do an analogous geometry-testing experiment in the universe, we find the equivalent of a perfectly flat horizon; consistent with a spatially infinite universe. There are always uncertainties in our observations so we cannot say for sure that the entire universe is spatially infinite. For example, if, in the boat you measure a flat horizon, maybe you are on a planet that is so big that the curvature of the horizon is too small to measure. With this caveat in mind, the more precise our measurements have become over the past decade, the flatter our observable universe seems to be – consistent with the idea that the entire universe is spatially infinite.

This has some important implications. One is that there are an infinite number of independent observable universes. That is, we

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can divide the entire infinite universe into an infinite number of finite volumes whose centres are more than 2 x 47 billion light years away from each other. We place each volume that far apart because that makes them independent of each other. No event that has ever happened in one ball has ever affected anything in the neighbouring balls. In a very real sense, these independent observable universes are other universes, beyond our observable universe.

If there are an infinite number of independent universes, then anything that can happen, will happen in one of them. Any objective reader of this newspaper would estimate the probability of a Kevin Rudd evolving on a terrestrial planet as very, very small. Call this probability ''e''. Maybe ''e'' is as small as one part in a googol (i.e. 10 to the power of -100) or maybe it is one part in a googolplex (i.e. 10 to the power of -googol). It doesn't matter how small ''e'' is, as long as it is not zero. If ''e'' is not zero then there will be an infinite number of Kevin Rudds in the universe, since ''e'' times infinity equals infinity: ''e'' x 8 = 8 . However, it is not easy to guesstimate the probability for an independent volume of the universe to produce a particular human being. I suspect that individuals may be so quirky, that their probability of happening is zero. If their probability is zero, then they would not evolve again, even in an infinite universe.

The wonderful dilemma these considerations lead us to is that either there are an infinite number of Kevin Rudds in the universe or that the probability of Kevin Rudd evolving is zero. Either way, this is just one of the lip-biting perplexities that the International Year of Astronomy invites us to ponder.

■ Dr Charles H. Lineweaver is from the Planetary Science Institute, Research School of Astronomy and Astrophysics and Research School of Earth Sciences, at the Australian National University.