Universe older than it looks

October 27 2014

Image credit: Hubble/NASA

When astronomers (Bond 2013) first dated the star HD 140283, which lies a mere 190 lightyears from Earth in the constellation of Libra, they were puzzled. This rare, star appeared to be rather ancient and was quickly nicknamed the Methuselah star. It is a metal-poor sub-giant with an apparent magnitude of 7.223. The star had been known for a century or so as a high-velocity star, but its presence in our solar neighborhood and its composition were at odds with theory. Moreover, HD140283 wasn't just an oddity from at the dawn of the Universe, formed short time after the Big Bang. Rather, it seems to be some 14.46 billion years old… which makes it older than the Universe itself, currently estimated to be 13.817 billion years old (estimated from the cosmic microwave background radiation).

Of course, it was ultimately revealed that the error margins on estimating the age of the Methuselah star were in fact much wider than the original research suggested, the astronomers add a margin of 800 million years. The error bars could have it a lot younger, which makes it among the earliest known stellar objects in the Universe, but certainly within the boundaries of time since the Big Bang. But, what of that upper limit on the age? Is there a possibility that this star could somehow be as old as the original measurements suggested but still lie "this side of the Big Bang?

Writing in the *International Journal of Exergy*, Birol Kilkis of Baskent University, in Ankara, Turkey, thinks so. In 2004, he introduced the Radiating Universe Model (RUM). This intriguing concept suggests that exergy, the energy that is available to do work and the first focus of thermodynamics theory in the 19th Century, will flow from the Big Bang to what Kilkis refers to a thermal sink of infinite size at absolute zero (0 Kelvin) far, far into the future. Using RUM, Kilkis calculated the age of the universe to be 14.885 ± 0.040 billion years, which is marginally older, in the grand scheme of things, than the microwave background estimate, but easily accommodates the original age of HD 140283.

Interestingly, Kilkis' RUM theory gives a new dynamic value to the Hubble constant and suggests that the expansion of the universe has been accelerating since 4.4 billion years after the Big Bang, which may well accommodate the notion of dark energy. Moreover, this accelerating rate of increase is itself slowing, which in turn may be accounted for by dark matter. Dark energy and dark matter are, as have been discussed widely, controversial physical phenomena for which we have absolutely no explanation whatsoever, but we do have observational evidence that suggests they are real. In addition, RUM hints that Planck's constant is not a pure constant at all but a cosmological variable, a point for which some supported was reported in 2013 by Seshavatharam and Lakshminarayana.

"The yet unasked-unanswered question is where the observable universe is expanding. If the expanding universe has a mass and volume, whatever its shape is, it must be expanding into another medium," says Kilkis. That "medium" is of infinite size and lies at absolute zero, thus acting as a thermal sink for the universe, which is a thermally radiating source lying within the sink.

More information: Bond, H.E., Nelan, E.P., VandenBerg, D.A., Schaefer, G.H. and Harmer, D. (2013) 'HD 140283: a star in the solar neighborhood that formed shortly after the big bang', The *Astrophysical Journal Letters*, Vol. 1, 13 February, p.765. arxiv.org/abs/1302.3180

Seshavatharam, U.V.S. and Lakshminarayana, S. (2013) 'Is Planck's constant – a cosmological variable?', *International Journal of Astronomy*, Vol. 2, No. 1, pp.11-15, article.sapub.org/10.5923.j.as … omy.20130201.02.html

Kilkis, B.I. (2014) 'An exergetic approach to the age of universe', *Int. J. Exergy*, Vol. 15, No. 1, pp.76–89. www.inderscience.com/info/inar … icle.php?artid=65108

Provided by Inderscience