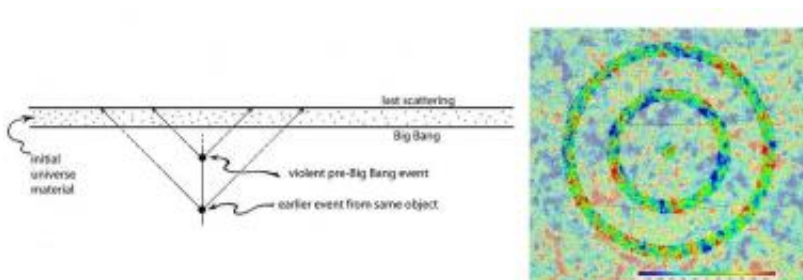


Scientists glimpse universe before the Big Bang

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Black hole encounters would have repeated themselves several times, with the center of each event remaining at almost exactly the same point in the CMB sky, even when occurring in different aeons. The huge amounts of energy released would appear as spherical, low-variance radiation bursts in the CMB. Image credit: Gurzadyan and Penrose.

(PhysOrg.com) -- In general, asking what happened before the Big Bang is not really considered a science question. According to Big Bang theory, time did not even exist before this point roughly 13.7 billion years ago. But now, Oxford University physicist Roger Penrose and Vahe Gurzadyan from the Yerevan Physics Institute in Armenia have found an effect in the cosmic microwave background (CMB) that allows them to "see through" the Big Bang into what came before.

The CMB is the radiation that exists everywhere in the universe, thought to be left over from when the universe was only 300,000 years old. In the

early 1990s, scientists discovered that the CMB temperature has anisotropies, meaning that the temperature fluctuates at the level of about 1 part in 100,000. These fluctuations provide one of the strongest pieces of observational evidence for the Big Bang theory, since the tiny fluctuations are thought to have grown into the large-scale structures we see today. Importantly, these fluctuations are considered to be random due to the period of inflation that is thought to have occurred in the fraction of a second after the Big Bang, which made the radiation nearly uniform.

However, Penrose and Gurzadyan have now discovered concentric circles within the CMB in which the temperature variation is much lower than expected, implying that CMB anisotropies are not completely random. The scientists think that these circles stem from the results of collisions between supermassive black holes that released huge, mostly isotropic bursts of energy. The bursts have much more energy than the normal local variations in temperature. The strange part is that the scientists calculated that some of the larger of these nearly isotropic circles must have occurred before the time of the Big Bang.

The discovery doesn't suggest that there wasn't a Big Bang - rather, it supports the idea that there could have been many of them. The scientists explain that the CMB circles support the possibility that we live in a cyclic universe, in which the end of one "aeon" or universe triggers another [Big Bang](#) that starts another aeon, and the process repeats indefinitely. The black hole encounters that caused the circles likely occurred within the later stages of the aeon right before ours, according to the scientists.

In the past, Penrose has investigated cyclic cosmology models because he has noticed another shortcoming of the much more widely accepted inflationary theory: it cannot explain why there was such low entropy at the beginning of the universe. The low entropy state (or high degree of

order) was essential for making complex matter possible. The cyclic cosmology idea is that, when a universe expands to its full extent, black holes will evaporate and all the information they contain will somehow vanish, removing entropy from the [universe](#). At this point, a new aeon with a low entropy state will begin.

Because of the great significance of these little circles, the scientists will do further work to confirm their existence and see which models can best explain them. Already, Penrose and Gurzadyan used data from two experiments - WMAP and BOOMERanG98 - to detect the circles and eliminate the possibility of an instrumental cause for the effects. But even if the circles really do stem from sources in a pre-Big Bang era, cyclic cosmology may not offer the best explanation for them. Among its challenges, cyclic cosmology still needs to explain the vast shift of scale between aeons, as well as why it requires all particles to lose their mass at some point in the future.

More information: V.G.Gurzadyan and R.Penrose. "Concentric circles in WMAP data may provide evidence of violent pre-Big-Bang activity." [arXiv:1011.3706v1](#)
via: [Physics World](#)

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