

112 Herald 5 May 2001  
see Job 38:7 and Genesis 1:3 "And God said"

# Heavenly music

Before man, or even the Earth, emerged the Universe might just have been a matter of sound, as **Steve Connor** reports.

**S**CIENTISTS have recorded the music of creation in an experiment using the astronomical equivalent of a time machine to go back to the origin of the Universe.

A telescope suspended from a high-altitude balloon circling the South Pole has detected harmonic "notes," which rang out like a bell in the first fractions of a second after the Big Bang.

Cosmologists believe these minute ripples of sound became the "seeds" of matter, which eventually led to the formation of stars, galaxies and planets such as Earth.

"Not only are we finding out the right notes of the Universe, we're finding what key it's in," says Phil Maudkopf of Cardiff University, the British team leader of the international Boomerang project to investigate the cosmic background radiation — known to be the "echo" of the Big Bang.

Paolo de Bernadis, of the University of Rome and joint leader of the Boomerang project, says the findings herald a new era in the understanding of what happened during the moments when the Universe was created.

He says: "The early Universe is full of sound waves compressing and rarefying matter and light, much like sound waves compress and rarefy air inside a flute or a trumpet. For the first time the new data show clearly the harmonics of these waves."

Andrew Lange, of the Californian Institute of Technology, the other joint leader, says that before these latest findings, the Boomerang telescope had been able to detect only one harmonic note of the Big Bang.

"Using a music analogy, we could tell what note we were seeing. Now we see not just one, but three of these peaks, and can tell not only which note but also what instrument," Lange says.

The Boomerang experiment involves 36 scientists drawn from universities and research institutes in

Britain, Canada, Italy and the United States.

The latest results were released this week at a meeting of the American Physical Society in Washington DC.

The Boomerang telescope, flying 36.6km above Antarctica where atmospheric interference is negligible, collected data on the microwave radiation left over from the intense heat of the Big Bang 12 billion to 15 billion years ago.

This microwave radiation was first detected in 1965, but it was not until 1991 that Nasa's Cosmic Background Explorer satellite (Cobe) detected signs of any structure within the radiation field that could explain the origin of matter.

Boomerang has now deciphered the nature of these structures, or ripples in the microwave radiation, and results show they form a harmonic series of angular scales like a musical score.

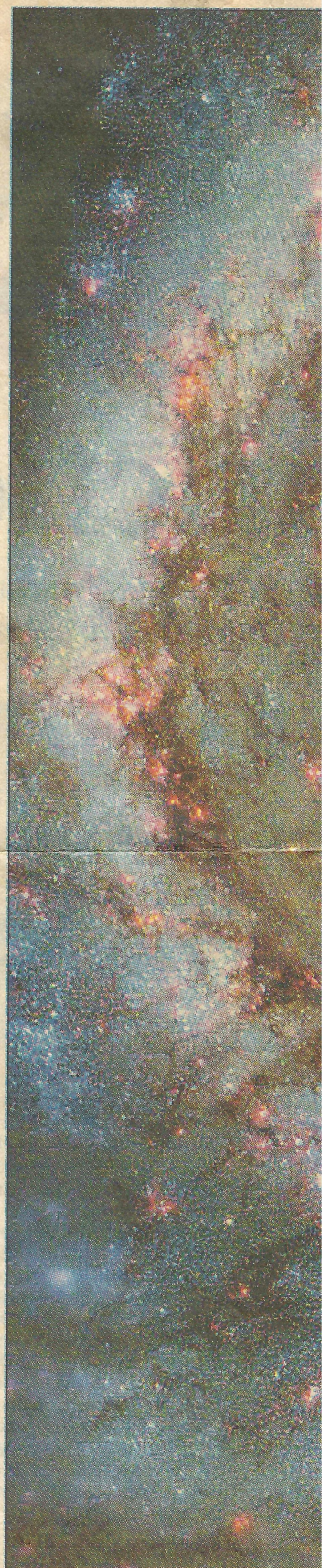
This is important because if the background microwave radiation was perfectly "smooth" and unperturbed, then it would be difficult for existing cosmological theories to explain how matter could coalesce under the influence of gravity into larger structures, eventually leading to the formation of stars and galaxies.

The findings are doubly important because they relate to the first fractions of a second after the Big Bang, when the Universe expanded from a minute point in space to something billions of times bigger, the so-called inflationary period.

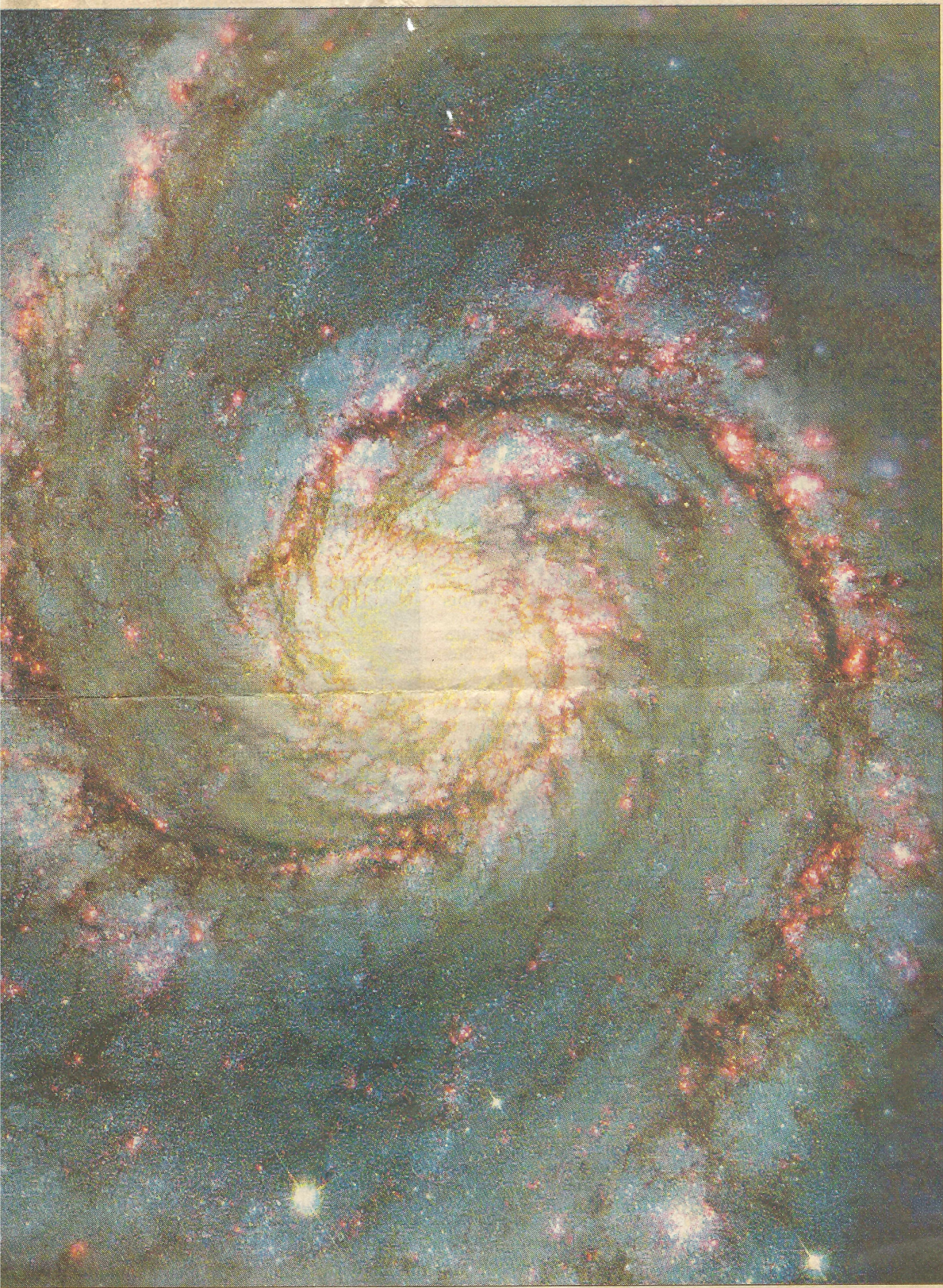
Maudkopf says: "These results are a tremendous confirmation of the inflationary model, and also agree extremely well with measurements of other astronomers using completely different methods."

The Boomerang images cover 3 per cent of the sky and are the forerunners of a project to map the microwave background radiation using two satellites, the first of which is due to be launched this year.

— INDEPENDENT







**THE CREATION:** Stars form in the dust clouds of the spiral arms of galaxies, such as the Whirlpool Galaxy, pictured by the Hubble telescope.

PICTURE / REUTERS / NASA