Applied mathematical theology

You have a message.

Gregory Benford

The discovery that the cosmic microwave background has a pattern buried in it unsettled the entire world.

The temperature of this 2.7 K emission, left over from the Big Bang, varies across the sky. Temperature ripples can be broken into angular-coordinate Fourier components, and this is where radio astronomers found something curious — a message or, at least, a pattern. Spread across the microwave sky there was room in the detectable fluctuations for about 100,000 bits — roughly 10,000 words.

Although different technical civilizations in our Universe would see different temperature fluctuations, they could agree on the Fourier coefficients. This independence of place, and the role of the cosmic background as cosmic neon sign for anyone with a microwave receiver, meant that any intelligence in the Universe could see this pattern.

But what did it mean? Certainly it would not be in English or any other human language. The only candidate tongue was mathematics.

Writing them as binary numbers, astronomers tried to fit mathematical sequences, such as the prime numbers, in any base. This and other mathematical favourites — π , e , the golden ratio, the Riemann zeta function — proved futile. More obscure numbers and patterns, from set theory and the like, also shed no light.

In despair, some thought the pattern might be random. But the Shannon entropy test showed clear non-random elements, and this nihilist idea faded away. One insight from Benford's law, which states that the logarithms of artificial numbers are uniformly distributed, did apply to the tiny fluctuations. This proved that the primordial microwaves were not random, and so had been artificially encoded, perhaps by some even earlier process. So there was a message, of sorts.

Cosmologists eagerly searched for clues and hit a dead end. The sequence was found to fit no model. This suggested immediately to even non-religious astronomers that the pattern might have been put there by a being who made our Universe: God, in short.

What would such a mathematical message mean, anyway? Only that some rational, counting designer had made our Universe. Beyond that, nothing would be revealed about the being's nature; although of course this proved the old claim, that God was a mathematician.

Rankled, the physicists quickly compared the observed sequence with the fine-structure constant, one of their favourites. The sequence did not fit.

This sent everyone back to fundamen-

easier for physicists? Because, obviously, God was one, too.

Sadly, no. Nothing seemed to work.

Perhaps the very idea underpinning science — that humans could understand the Universe — had hit a wall. This helped both science and religion.

Excitement increased. If the being was not saying something obvious, then maybe humans had not understood the Universe well enough to make out the message. Governments poured money into mathematics

and physics. The astronomers protested. If the night sky was a tale told by God, they could read it. The cosmic-neutrino and gravity-wave backgrounds had not yet been detected, but they could also carry the Word. So it came to be that the cosmologists, too, received the blessing of a large research bounty.

These huge increases in funding drove a renaissance of modern science. Data processors, statistical theorists, observers of obscure spectra — all received a share. Vast telescopes tuned to the vibrations and emissions of

the Universe glided in high orbits, their ears cupped to the distant and primordial.

This largesse produced an economic boon, as many spin-off technologies benefited commerce. Religious fervour damped, as each faith felt humbled by this proof that the Universe had meaning, yet mankind was not yet advanced enough to fathom it.

At the same time, attention focused on the injunction to mankind in the Old Testament — echoed in other religious founding texts — charging humanity with being the stewards of Earth. The environmental movement merged with the great religions.

Within a century, active adjustment of Earth's reflected sunlight, and capturing of carbon in the oceans and lands, had averted the greenhouse disaster. Church attendance was enormous. Efforts to enhance our knowledge and skills had averted many gathering social conflicts.

Work on the message continues in the new university departments of applied mathematical theology. Yet to this day, it remains untranslated. Perhaps that is just as well.

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tals. Current theory said that tiny temperature fluctuations in the microwaves came from little bumps in the potential function that governed the inflation of the very early Universe. Tinkering with those quantum fluctuations, a being could write something simple but profound: God as a quantum mechanic. If, for example, the designer could encode little squiggles on the potential, then the fine-tuned primordial density fluctuations would not be exactly scale-free, and that's where the sky-wide microwave patterns came from.

So of course the physicists followed their current fashion. When comparison with other favourite numbers — the dimensionless ratios of masses and energies and the like — all failed, they tried more advanced theories. They tried prescriptions for various symmetry groups that came from the Lie algebras, as three of the four fundamental interactions we know reflect such gauge theories. No help.

The physicists, who had long been the mandarins of science, then supposed that clues to the correct string theory, a menu currently offering about 10^{100} choices, would be the most profound of messages. After all, wouldn't God want to make life