Medieval multiverse heralded modern cosmic conundrums

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LIKE the cosmos sprinkled with stars, medieval times were dotted with beacons of scientific light.

Physicists have translated a 13th-century Latin text into modern equations and concluded that the English theologian who wrote it had unwittingly predicted the idea of the multiverse in 1225. This news arrives within days of cosmologists unveiling a glimpse of the universe in the first moments after the big bang, with what they saw bringing the multiverse concept closer to reality (see "Ripples of the multiverse").

Tom McLeish at Durham University, UK, and his team applied modern mathematics to a medieval treatise on light, entitled *De luce*, by philosopher Robert Grosseteste. The work built on Aristotle's idea that the motions of the stars can be explained by embedding Earth in a series of nine concentric spheres that make up the universe.

In *De luce*, Grosseteste proposed that the universe began with a flash of light, which pushed everything outwards from a tiny point into a big sphere. He also assumed that light and matter are coupled, and that the way they behave as the density of matter decreases produces waves of inwardly propagating matter, which ultimately form the nine spheres.

Turning the Latin words into modern equations, McLeish's team modelled the process Grosseteste described and found that it yields exactly the sort of nested-spheres universe the philosopher envisioned.

And unbeknown to Grosseteste, his process also points to one of the most puzzling possibilities of big bang cosmology – the multiverse. Current multiverse models agree with observations only if certain parameters are given specific values – if the forces holding matter together were slightly stronger or weaker, for instance, it would be impossible for us to be here to observe the universe. This is known as the fine-tuning problem, and one way to solve it is to say that there must be an infinite number of

universes in which all physical outcomes are possible, and that we live in this one because it is well-suited for life.

The outcome of Grosseteste's model also has a fine-tuning problem: change the way light and matter couple together, and you can get different numbers of spheres. That means the nature of the medieval universe also depends on key initial conditions, suggesting you need a multiverse to solve the conundrum (arxiv.org/abs/1403.0769).

"Obviously he didn't realise that there could be a multiverse," says McLeish. "But what will people in 800 years' time be thinking about the assumptions that we're making today?"

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