

THE PRIMEVAL ATOM

Amanda Bonner: What I said was true, there's no difference between the sexes. Men, women, the same.

Adam Bonner: They are?

Amanda Bonner: Well, maybe there is a difference, but it's a little difference.

Adam Bonner: Well, you know as the French say...

Ruth Gordon (1949)

I well remember the day when Eddington, rather shamefacedly, showed me a letter from Lemaitre which reminded Eddington of the solution to the problem which Lemaitre had already given. Eddington confessed that, though he had seen Lemaitre's paper in 1927, he had completely forgotten about it until that moment.

George McVittie (1967)

In his later career, Lemaitre often had to deal with the suspicions of scientists ... who suspected that his primeval atom theory was inspired by religious faith.

John Farrell (2005)

At some time in the past (about 13.75 billion years ago), the distance between neighboring galaxies must have been zero. In other words, the entire universe was squashed into a single point with zero size, like a sphere of radius zero.

Stephen Hawking (2005)

The conceptual novelty of Lemaitre's hypothesis may be illuminated by looking at how it was received by physicists and astronomers shortly after its introduction in 1931. It took some time until it was noticed at all.... When it did become known, the general response was either dismissal or neglect, in a few cases even ridicule.

Helge Kragh & Dominique Lambert (2007)

What is it with those Belgians? Daydreaming of my own detective gets me thinking how his world would look to him. He'd notice Belgians are severely over-represented in his scene. His own alter ego Poirot is a Belgian. Of course Poirot is a figment; he exists in Christie's mind. But Georges Simenon is real and he's a Belgian. Frank's other alter ego Maigret is a figment too. He lives in Simenon's imagination. Then there's Georges Lemaitre. As figments go he'd be a bit far-

fetched. But he is real. And he's a Belgian. The reason he's a bit far-fetched lies partly in the physics paper that he publishes in 1927. He writes it in French. He sends it to a Belgian periodical, more popular than scientific. It is, says Eddington with understatement, 'a rather inaccessible journal.' Which is to say, Lemaître buries it. Could this be a choice that changed the world?

Last night I found his paper. Frank is reading it. That is, not knowing French, he's reading a translation. Why would he take a look? Well, it states Hubble's Law ahead of Hubble's observations. Lemaître does it with GR; he devises the Big Bang. Then he writes an essay on the way the universe began. Frank perks up when he hears this. The essay's titled 'The Primeval Atom'. Atom is his word for it in English; it's *Atome* in French. Just what he means by it is less than clear because the atom is all Greek to him; it's not yet understood. What he says, this time in English in a leading journal, is that it gave rise to the universe in some sort of explosion. Maybe this could make it all expand.

Frank asks: What happens? To the *idea*, I assume he means. Well, a funny thing happens on the way to the forum. But not funny like the musical. Lemaître sends his '27 paper to his mentor Eddington. Eddington forgets it for a year or three. In time Lemaître's expanding universe survives and thrives. His idea of how it all begins does not. Could it be that physics dumped the baby and retained the bathwater? It's all about the politics of physics with a side order of God.

In October '27, the Solvay Conference meets in Brussels to discuss the fate of quantum theory. Lemaître is not invited. But having read Lemaître's paper, Einstein meets him there and says, 'Your calculations are correct but your grasp of physics is horrendous.' This is the science of the day. It holds—on no sound basis—that the universe has always been there in the form that all see in the sky. There is no conception in the physics that's in fashion that time had a beginning. Lemaître has yet to write about his *atome*. He has solved Einstein's equations. The math shows that there *might* be a beginning. The math *is* right. But Einstein's curt dismissal's a bad start.

He's moving stuff to make a butt-sized bare spot on my desk. What did he mean by physics anyway? he asks. He maybe feels he is out of his depth. He is. So is Lemaître. Lemaître, I tell him, has a new idea. But he doesn't have new physics to support it. His timing is not good. This all happens just when physics is abandoning philosophy. Increasingly what physics *is* is a good question. Then Eddington steps in.

Eddington has stature. For ten years he's pitched to the English-speaking world for relativity. He takes up a new cause—the expanding universe. Then, having found Lemaître's paper, in his pocket so to speak, he brings it to a wider audience three years too late.

Well-connected, he's a key advocate. But while he espouses the expanding-universe idea, he can't accept that the expansion must begin. In a much-publicized American address he dismisses the idea of the start of space and time as 'fireworks'.

Lemaître bases his response on quantum theory. It says the number of quanta in the universe must increase. So, he says, 'If we go back in time we must find fewer and fewer quanta, until we find all the energy of the universe packed in ... a unique quantum.'

In time Einstein comes to be a backer. He tells a California seminar Lemaître has 'the most beautiful and satisfactory explanation of creation to which I have ever listened.' The public laps it up. Most physicists know better. They never give the concept their attention let alone support. The barrier is not his flaky atom; it is the idea that the universe *began*. Much later Kraugh and Lambert say that 'if a dynamically evolving, relativistic universe was unthinkable in the 1920s, its sudden beginning in a singularity-like state was doubly so.'

In '31, Eddington takes a swing at it. With time-reversal physics he says: 'Following time backwards, we find more and more organization in the world. ... [W]e must come to the time when the matter and energy of the world had the maximum possible organization. To go back further is impossible. We have come to an abrupt end of space-time—only we generally call it the "beginning".' But then, tossing his own logic off the dock, 'Philosophically, the notion of a beginning of the present order of Nature is repugnant to me.' This last is not physics. Nor philosophy. It's faith. It is soon shown to be misplaced. With friends like this Lemaître has no need of enemies.

Of course one can find other reasons why his paper is neglected. There's the way he buried his first paper; and his clumsy explanations; Einstein's early opposition; Eddington's half-baked and long-delayed support; the success of Big Bang calculations; the mores of the time. All contribute to a curious conclusion. The expanding universe cuts loose from its beginning. Joined at the hip from birth, they take two different paths. The Big Bang will survive. It is the central pillar of cosmology today. Its beginning, the primeval atom, sinks into oblivion. Even as history it elicits little interest till 2005, when Farrell writes a book he calls *The Day Without Yesterday*.

Then there is the religious factor. It makes me wonder. Abbé Lemaître is a Roman Catholic priest. At the time he writes his essay he is teaching at a Catholic university. He dresses as—he *looks*—a priest. Many see his concept as not scientific but religious in its nature and perhaps its purpose too. Many, including Einstein, say he's using science to promote beliefs.

To the 1958 Solvay Conference (to which as Father of Big Bang Cosmology

Lemaître is invited) he declares that his primeval-atom theory ‘remains entirely outside any metaphysical or religious question.’ A few years later, in an interview with *Newsweek*:

Asked about potential conflict between propagator of the faith and propounder of the first modern scientific theory of creation, Lemaître said, “This is constantly—how do you say—thrown up to me. Religion has no bearing either on my theories, or that of the steady state. An atheist or a Christian could logically support either one of them. ... I do not believe that God ever intended to disclose to man what man could find out for himself.”

Kraugh and Lambert say today that ‘the allegation [of religious purpose] is unfounded.’ But a reviewer of *their* paper thinks it apt to ask, ‘Was Lemaître the scientist being guided by Lemaître the Catholic priest?’

In the shadow of this question, physics now embraces the Big Bang but paradoxically gives scant attention to how it came to be. What went wrong? Was it really the religion thing that took his *atome* down? In the end it seems to me it was the influence of Eddington that did it in with a toxic blend of mixed message, waylaid publication and capricious support. Whatever. Its fate was sealed in 1951 when, to Lemaître’s horror, Pope Pius XII embraced it into Catholic dogma.

GR, says Hawking, points to a different beginning. One way to see this is that the curious conditions as the universe begins cause Lemaître to think a quantum is the key. But Einstein doesn’t think of these conditions; not at all. It’s as if it could begin with no quantum whatsoever. Like Bonner’s this may be a little difference. Indeed, *sensu stricto*, there can be no smaller difference than one quantum versus none. But in a larger sense the difference is huge. Could it be a pivot point for physics?

Of course what the French say is: *Vive la différence!* It seems Frank doesn’t realize that Bonner’s double entendre means they speak of sex. When I point this out he only snorts as if to say they always do.

But then, seen differently, this difference is the object of his quest. What does he think? I ask. He looks at me. Methinks he thinks I jest.