

BEGINNING THE BEGUINING

A beginning is the time for taking the most delicate care that the balances are correct.

Frank Herbert (1965)

He was not really thinking. Only scraps of thoughts which didn't add up to a coherent whole.

Georges Simenon (1967)

If the expansion did have a beginning then we are faced with further questions: is this 'beginning' merely the start of the expansion of the Universe that we see today or is it the Beginning, in every sense, of the entire physical Universe?

John Barrow (2000)

Are there additional spatial dimensions beyond the three for which we have very firm evidence? I cannot think of a deeper question in physics today.

Michael Turner (2002)

Don't start with space or anything moving in space. Start with something that is purely quantum mechanical and has, instead of space, some kind of purely quantum structure.

Lee Smolin (2007)

Many physicists now routinely speak of time and space emerging from something—no one can quite say *what*—at the moment of the big bang.

Dan Falk (2008)

String Theory's need for six extra dimensions has eluded a simple explanation, even after more than thirty-five years.

Leonard Susskind (2008)

Days later he says maybe it was aether. He remembers thinking Einstein's saying that he doesn't need it was the kiss of death. He was thinking: Now he *owns* it. The Pottery Barn rule is what I think of when he tells me. He was thinking vaguely about Einstein and his reinvented aether. I recall a disembodied feeling and remember Chandler saying, 'The surf curled and creamed, almost without sound, like a thought trying to form itself on the edge of consciousness.'

At that moment there's an all-consuming feeling. Suddenly he's bursting with it, desperately trying to make notes. I think, first, what did it look like? He

gives no thought to this. With a kind of mental lurch that makes me shudder, his unspoken question brings him back to the Beginning. I find myself reaching for, not keyboard, but a pen and an old envelope.

I+B:

... I scribble for him, and then:

1 quantum

Entire universe

Primeval ~~atom~~

~~Nothing else~~ Not even

No space

No time

The queasy feeling stops as I see what my hand has written. It looks odd, not like my writing. I read. It seems to fit the Primal Principle. A quantum. Lemaître doesn't ever say exactly what his quantum is. His attempts are not simple. An atom, he says at one point. But he does say too that, for his quantum, space and time fail to have meaning. Of course he knows nothing about atoms so it's not surprising his is unconvincing. A sudden sinking feeling: Is Frank after much the same? Surely not. He has eighty years of evidence to help him. He has *facts* Lemaître couldn't dream about.

"What does it look like?" he asks, as if it's his question.

Well, 'look like' only goes to show how lacking language is for this task. It's the kind of question that needs math to ask.

"If it is it must have size."

Well, I think, that means dimensions. But it can't have straight dimensions because that would mean space. So its dimensions must be tied up in some kind of loopy tangle.

"Yes," he says, sounding like he's talking to himself instead of me. "This thing has six dimensions."

Just like that, he adds it to his list. My hand writes for him:

6 dimensions

It's a parameter. A number chosen by a physicist to make a theory fit the facts. Well, it's a detective choosing this one. Is it picked to fit his instincts? Does he have some notion of what 6-D does? Does he know that physicists invent nine space dimensions, then fold six, to make their string math work? Is he saying six come *first*, already folded? Could this fit in Feynman's terrible straightjacket? As I wonder whether strings give reason to pick six he cuts me short.

“That makes it a Calabi-Yau doohickey.”

A Manifold is what he means. How does he know the names? Was he there when I did strings for Flatfoot Frank? Does he know that it’s a sort of space-like thing but not our sort of space? As if of its own accord my hand jots:

Manifold

In a bid to help him out I search calabi+yau. Around four hundred thousand Google hits; my rule of thumb would say that a few hundred may be real. The top ten hits all mention Manifolds; Calabi-Yau doohickeys seem to be well known. Their links dive into heavy-duty math.

Then there are the pictures. They look weird.

“Tiny,” he says as I click one.

Does he see the picture?

“Must be tiny,” he repeats.

But what’s *tiny*? At this point in time—if there *is* time—tiny has no meaning. There’s no way to measure size. I’m sure that size can only come with space. It’s right there in his notes: No space. And so there *is* no tiny.

But then I think: Space must come somehow. When it does the Manifold may turn out to be very small. It’s not *in* anything. As he says, not even nothing. The six curled-up dimensions *are* the all. This is his Beginning? One parameter already and so far as I can see it explains nothing. The Problem of Parameters shows this can be a slippery slope. It will be a touchstone: Can his Manifold explain the universe we see without a hundred more parameters to make it work?

Then there’s the obvious next question. Is there something else?

“Lemaître stuffed his atom full of matter,” he says suddenly.

It’s true. And now the matter has to be within the six dimensions. There is no other place for it to be but there. He’s speaking of a lot of matter—a whole cosmos of it. A squidzillion gigatons squeezed in a tiny Manifold?

“Well, it may seem a lot to pack in there but at this point there is no *there* there”—he says this in a way that says he likes the phrase—“and there is no way to know that it’s a lot.”

In fairness he’s not doing much more squeezing than Lemaître did. And physicists aplenty are on record squeezing it into a smaller size. It’s hard to see a way to get around it. Either it is there in the beginning or it’s not. If it is he’s stuck with squeezing. Or, if not, then what? Some say it comes out of nowhere. Does *he* say that it comes out of nowhere? It seems not.

And he’s right, it isn’t small. *It’s all there is*. There is nothing to compare with size-wise; there’s no metric, as the physicists would say. If there were a way to measure things inside the Manifold there’d be no way to compare them with anything outside. Indeed there is no outside. So while he wonders where the

matter is, I'm wondering: Where's space?

And suddenly I see that space's absence is a blessing. If the Beginning did begin *in* space it would be the biggest black hole ever seen. 'Seen' I'm sure is not the word I want here but its gravity would keep it down. This worries me. Gravity may be on hold but will kick in as soon as there is space.

Yet, notwithstanding what he says, I sense he's not concerned about the stuff that's stuffed into the Manifold. He's thinking, or he's got me thinking, that there is no *then* then. Until time and space are in existence, what is in the Manifold cannot be energy and mass. Energy has meaning over time. Mass has meaning within space.

"This is where you screwed up, Georges," he mutters, maybe to himself.

What, I wonder, could he mean? Lemaître screwed up many ways. But the one that Frank would think of now is the explosion. Maybe he is thinking there is *no* explosion as the universe begins.

I'm keeping track of something else. The quantity of mass—however much it is—is a parameter. That's number two. How many more? Maybe he doesn't yet get what they are about. They specify the universe and shape its laws. But if he has too many all this will amount to is another elephant.

Taking stock, I rework on a sheet of printer paper his list of what he knows or, rather, what I think he thinks:

One thing

A manifold

Calabi-Yau

Six dimensions

No space

No gravity

No time

No mass

Mass-energy-in-waiting

Utterly isolated - not even

No relationship to anything except itself

Must have rules

Rules must make space

Rules must start time

Two parameters

Feeling lost, I'm thinking what is next?

He says nothing. Which leaves me to try to work out what he's working on. In fiction the detective is concerned about the sequence of events. Sequence (the butler leaves the room; the maid sees him go; then she hears the shot) says something of causation—not what causes what but what *could not* cause it. In this case he knows he must begin with the Beginning. But the fact is that, to pin it down, events *after* the Beginning must be kept in mind. They are part and parcel of the concept. Otherwise he will be stuck with a beginning that does not begin or that begins something that isn't right.

Detectives of the fictional persuasion often detect clever efforts to confuse them about sequence, linked to a cast-iron alibi. Well, he knows three things that will be needed—space, time, matter. Maybe they have some sort of sequence or priority. Not exactly in the sense that any one comes *after* any other. This would have no meaning until he has time. Could he think of them in some sense that makes sequence more about priority? What would he need to make sense out of what?

I can imagine space that has no time. Or maybe I can't. But it's even harder to imagine time if there's no space. Time seems to be, if not a property of space, at least the junior partner in Spacetime. It's the only one of four dimensions that requires the speed of light, which depends on space dimensions, to define it.

Likewise some have thought of space that has no matter (though others say that this is meaningless) but no one's ever thought of matter with no space. In fact recent fashion seems to think of matter as, like gravity, a property of space.

I never tried before to get inside his mind. For my efforts now I have a headache. It looks like a long night. I fetch water for fresh coffee. As it's filling, suddenly it dawns on me what he has done. He is the cosmos' farthest-flung explorer. He has moved outside the universe. He is not even nowhere in not even nothing noting what is going on. He has solved the problem of QM's observer and it shows she should have listened to me. He got there because all he *is* is fiction. QED.