OVER THE HORIZON

Lay hold upon him Priam, hold him fast
He is thy crutch; now if thou lose thy stay,
Thou on him leaning, and all Troy on thee,
Fall all together.

William Shakespeare (1602)

All Nature is but Art, unknown to thee;
All chance, direction, which thou canst not see
All discord, harmony not understood.

Alexander Pope (1732)

In the end the machinery will be revealed, and the laws will turn out to be simple.

Richard Feynman (1965)

It is surely a cultural deprivation to be unaware of the chain of events through which some mysterious genesis nearly 14 billion years ago triggered the emergence of atoms, galaxies, stars, and planets.

Martin Rees (2009)

Even when you are dealing with things that are unimaginably remote from human experience, I think it's important to think about them in a human way.

Oliver Sacks (2010)

The curse of Cassandra is that the future, its connections, the way one fateful thing depends upon another, lies unfurled before her eyes but none will heed. Cassandra warns, or Shakespeare has her warn, about impending peril. He has her brother Troilus dismiss her importuning out of hand:

> This foolish, dreaming, superstitious girl
>
> Makes all these bodements.

These bodements, as the Bard has Troilus call them, happen. I on the other hand see nothing or not much that's not in plain view and my friend, if he foresees, has not foretold. I stick close to Pope. I keep my distance from Nabokov; his cosmology is too confusing. Of what am I afraid? It's not of her or her devices. Maybe I see something but do not know what. While checking on him, on his voice I mean, I came on Szasz's saw: 'If you talk to God, you are praying; if God talks to you, you have schizophrenia.' It worried me a bit. I know Frank is not

God. Maybe I invented him but that's the case for any fictional detective. In fact in fiction it's the very essence of normality.

But what he has—*we* have—done here is not normal. Those abstract worries about choices that I pulled together for her seem less abstract now. The connectedness of everything from the Beginning has me in a daze. Indigenous societies that we think primitive conceived of their reality this way. This connectedness *is* Buddhadharma for two thousand years. I'm not used to it. It seems to challenge everything I think I know. When I make a choice do I change everything? An entire new future for the entire world? If I *have* a choice that is. And what *is* this universe entire (Omar Khayyám again) with which I maybe play?

I start out thinking that in each direction there's a place in space past which we do not see. This furthest reach is easy to compute yet also is not easily computed. The conflicted reason is, it's not clear here what 'furthest reach' might mean. One way to understand these words leads to an easy calculation. The light we see from the most distant galaxies today has traveled about thirteen billion years. So the distance we can see today is this time multiplied by the speed of light; in other words it's thirteen billion light years. What's confusing?

Well, these same galaxies have been moving further from us since the day that they gave off the light we see. When that light left them they were leaving us at near the speed of light. The reason is space is expanding. This isn't the confusing part. The confusion starts with realizing this has distant objects leaving faster than the speed of light. It's even more confusing when one checks it out and comes across all kinds of explanations why they are *not* leaving faster than the speed of light. After lots of reading I'm convinced these explanations are all wrong. Davis and Lineweaver call them 'expanding confusion' and I buy their line. The speed of light's a property of space that sets a limit on what mass or energy can do *in* space. It doesn't set a limit on what space itself can do. Those galaxies recede with faster-than-light speed and it's accelerating. Thus the most distant galaxies we see are now some 50 billion light years from us, if 'now' has any meaning.

So there *is* a limit to how far we see. Much of the universe, maybe almost all of it, is over our horizon. Most—but not quite all—of what goes on out there we here on Earth will never know. Not quite all since things may wing their way from outside our horizon into what from here we then can see. Whatever then and we may be.

So what is out there? Well, there is no reason to assume that it is different from what we see. The simplest notion is that it's essentially the same. But we don't *know* if this is true. This opens doors to speculation; other notions are in vogue. Is what we *can* see a small relatively uniform space in an infinitely large

and much more variable universe? Could there be unseen zones where physics is quite different? Or could our universe be one of infinitely many others? Is it possible that every time each person makes a choice of any kind the universe divides in two, thus giving substance to both choices? Some say most physicists believe something like this.

Such speculations may arise around the time dimension too. There's an industry at work on what went on *before* Time Zero. Buckaroo Banzais like Penrose study whether the Big Bang was a Big Bounce—whether we are in an endless string of universes, each of which expands until its gravity collapses it in a Big Crunch and then it bounces so to speak into the next: . . . crunch, bounce . . . crunch, bounce . . . crunch, bounce. It would be rude to ask how *this* began! Some (Penrose prominent among them) say that there may be a way to tell if this is so but so far there is not. The philosophers (Penrose prominent among them too) ask: If there's no way to tell, then is it meaningful to say it may be so? It seems to me that the discussion may have merit. But if after the discussion's done there never can be answers, then these speculations seem to me to be unscientific fiction. But then, far be it from me to bad-mouth fiction.

His Beginning offers simple answers. It says there is just one universe. It says that it is finite, closed and almost flat. It says that all of it is much like what we see. It says the laws of physics are the same all over. It says there was no Big Bounce.

"And never will be."

Is that him? Has he come back? Does he know Penrose is just playing with GR? He says no more. But his comment gets me thinking of Lineweaver's question from way back: How *will* it end?