THE PROBLEM
OF THE SPECIAL FRAME

The introduction of a "luminiferous ether" will prove to be superfluous inasmuch as the view here to be developed will not require an "absolutely stationary space" provided with special properties.

Albert Einstein (1923)

The sun is moving at 1,332,000 kilometers an hour compared with a distant horizon defined by the cosmic microwave background radiation.

Mike Hudson (2012)

This job gets weirder when I think about it, which is every day. I scan some sites; I google; check some Wikis; read some books. Then I write about some haunting problem. Who am I, he well might ask me, to prescribe the Problem? The only answer that I'd have is: I am the prescriber that he has.

This morning's problem, as I've sussed it out, is this: How does one know if some object's moving? Well, get out the tape measure (a good detective always has one); measure distance to the object. Wait; then measure it again. If the distance changes then the object must be moving.

The Problem of the Special Frame is all about the far end of the tape. You have to put it someplace, on some other object even if it is a fiction like a Frame of Reference or, as Einstein says, an aether. How do you know that *that's* not moving?

I remind him that a Frame of Reference is a place from which to watch what's going on. He could stand on the sidewalk or breeze by on a bus. There's no way to say that what he sees is special just because he's on the sidewalk rather than the bus. Why? Well, the sidewalk is stuck firmly to the Earth. Earth's surface, from its motion of rotation which depends upon location, is moving rather faster than the bus. The Earth itself moves round the Sun at 18 miles per second. In turn the Sun orbits around the center of our galaxy at 140 mps. Then the galaxy is cruising at 25 mps in the Local Group, which circles at 375 mps in its galactic supercluster, which too moves relative to any reference that he might choose. The sidewalk, in short, moves. It moves far faster than a bullet, not to mention that it gyrates through the cosmos on a madcap course that makes Korean b-boys' dance-moves seem sedate. He knows not of b-boys so I tell him, check it out.

Before Galileo it's assumed there *is* a special sidewalk. It is an unmoving place for one end of the tape—the Special Frame. It's special because—everybody must agree—it doesn't move. So, motion measured from the Special Frame is 'absolute'.

Galileo gives the lie to this idea. He observes that, when inside a ship, he can't tell if it's sailing or just bobbing at the dock. He observes fish in an onboard fishbowl and butterflies inside the cabin, and says they swim and fly the same if the ship sails or it does not. Well, in truth it isn't clear he does observe them. It could be he just *thinks* them; maybe *he* invents the thought experiment.

Post-Galileo, everybody knows there *is* no Special Frame. All motion must be relative; anyone can tag their tape-end anywhere. Anybody's anywhere is just as good as anybody else's. This is the relativity that Einstein later puts to such good use. It becomes a basic principle of physics. Until recently, that is.

Today it seems the Special Frame is back! Which brings us to the Problem of the Special Frame. But I start him off this way: If as some say it all starts at a point, that point might seem to be a Special Frame. Of course it's not that easy. Where is it today? There is no way to find it. It vanishes in the Beginning without trace. It leaves not even, as the Red Queen apprehends, a memorandum of its former whereabouts. So it seems. How can I explain to him it isn't that it isn't anywhere; it's everywhere! It isn't *in* the universe, it *is* the universe. But—a big but—could the *universe* provide a Special Frame? Well, like I told him, almost all the universe has also vanished. What we can see of it is like a grin that's lost its Cheshire Cat. But some say this grin is good enough. The Big Flash picture bears a message in its colors. To read it we must see: How is the picture taken?

And the answer is: It isn't. Turns out it's manufactured, bit by bit, like this: A camera points up to the sky. It looks for infrared—a fancy term for short-wave radio—from that direction and records how hot (or not) it is. Then it points in a new direction. Each measurement becomes a pixel. A computer program puts the pixels in the picture. It's the *computer* that gives each its color. It assigns the color based on temperature the telescope detects. In other words, the program paints the picture.

The instant that he hears this he takes over. He is the detective and the pixels are the evidence. What about the chain of custody?—he's not asking, he's demanding. How do we know that the computer paints exactly what the camera sees? Back to Google. We dig deeper. Ten minutes later he's the hero when we find that *it does not*. Actually, the computer tunes the color up or down depending on which way the camera points. It cools down a pixel that is taken in the direction of Earth's motion; it warms up each pixel snapped the other way.

We should have expected this. Hubble showed that color red-shifts—cools—

when source and receiver move apart, and vice versa. When the camera moves toward the source it looks hotter, bluer. So the scientists program their computer to remove this shift. If they don't, some of the picture is too red and some too blue.

Why does this matter? Well, it says there *is* a Special Frame! It's the frame of the universe itself, or what we see of it. It is unique, and that's enough to make it special. He can be sure that it exists because he knows exactly how it can be found. He'd need a spaceship and a microwave spectrometer. It's the Frame of Reference of his spaceship when the average color is the same in all directions in the absence of corrections.

Amidst all this he'll need to keep his own perspective: Is the Special Frame a clue? My bet is he needs to focus on this Problem: Of what is the Special Frame composed?