

## 4.2: Stripped-down Free-float Frame

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### throw away most clocks and rods

Troubled thoughts fill us tonight. We dream about invariance of the spacetime interval (Chapter 3). In our dream we find ourselves aboard the rocket used to establish that result (Section 3.7). However, the numbers somehow have changed from meters of distance and meters of light-travel time to light-years of distance and years of time. Suddenly we see things in a new perspective. Three revelations crowd in on us.

The flash of light that got reflected did its work - revelation number one - in establishing the identity of the spacetime interval as measured in either of the two frames. We can remember invariance of the interval and forget about the reflected flash. Eliminating it, we eliminate mirror, photodetector and, most of all, those upward-extended arrays of printout clocks in rocket and laboratory frames whose only purpose was to track the light flash.

The economy goes further. For us aboard the rocket, one reliable calendar clock is enough. As we start our trip from Earth in our dream, that clock by a happy coincidence shows noon on the Fourth of July, 2000 A.D. - and so do clocks at the Space Agency Center on Earth. We celebrate our start by setting off a firecracker.

### ***Retain a single string of Earth-linked clocks***

Later by 6 years - for us - and with a long shipboard program of research and study already completed, our rocket clock - still in our dreams - tells us it is again noon on the Fourth of July and we set off a second firecracker. At that very instant, thanks to the particular speed we had chosen for our rocket relative to Earth, we are passing Lookout Station Number 8. Lonely lighthouse, it has in it little more than a sentry person and a printout clock, one of a series that we have been passing on our trip. They have been stationed out in space, fixed one light-year apart according to Earth measurements.<sup>1</sup> Each clock is calibrated and synchronized to the reference clock on Earth using a reference flash as described in Section 2.6. The laboratory latticework of Figure 2.6.1 has been reduced to a single rightward-stretching string of lookout stations and their clocks. That we can thus simplify our vision of what is going on from three space dimensions to one is our first revelation.

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#### 1 Retain a single string of Earth-linked clocks

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