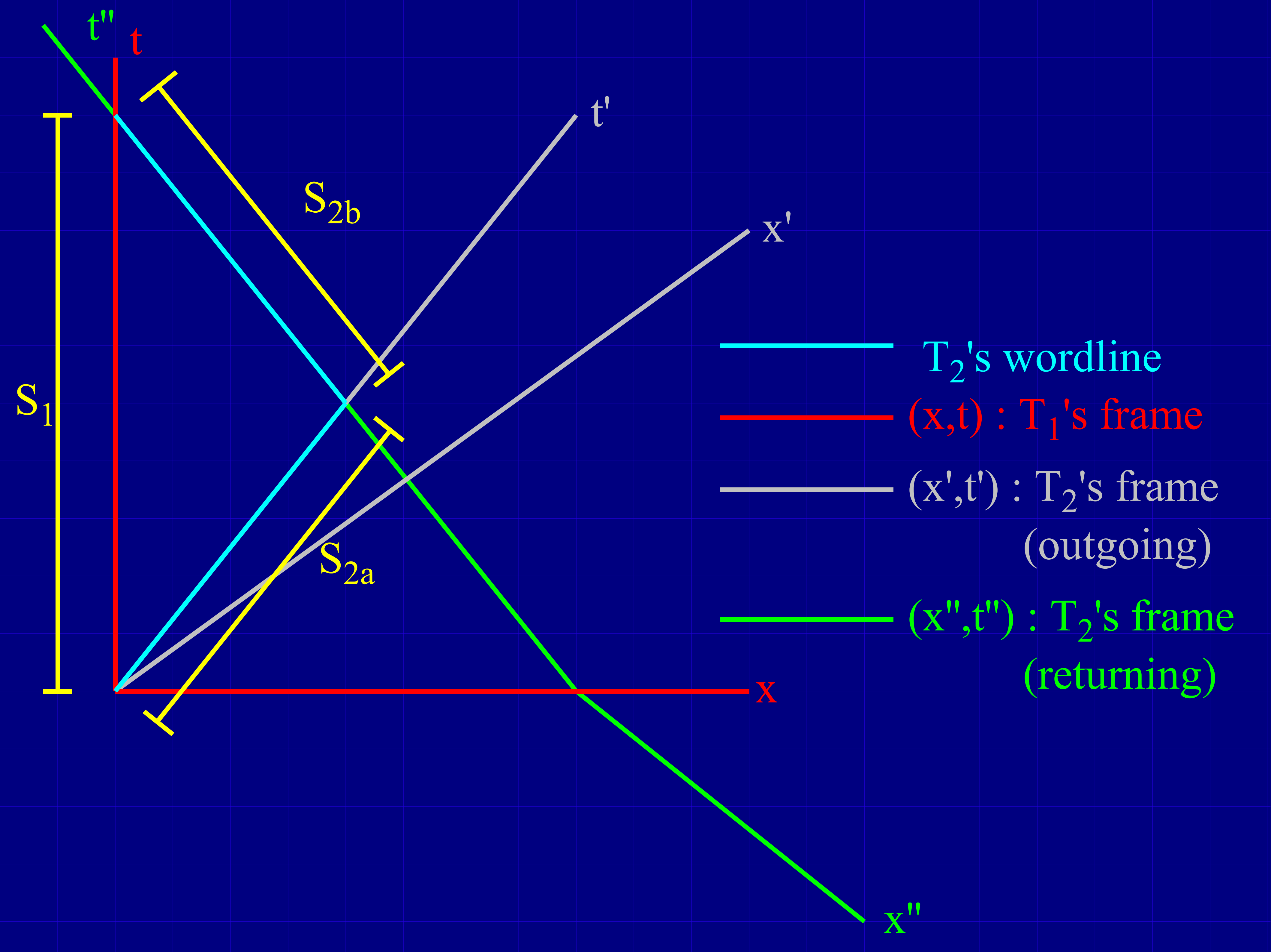
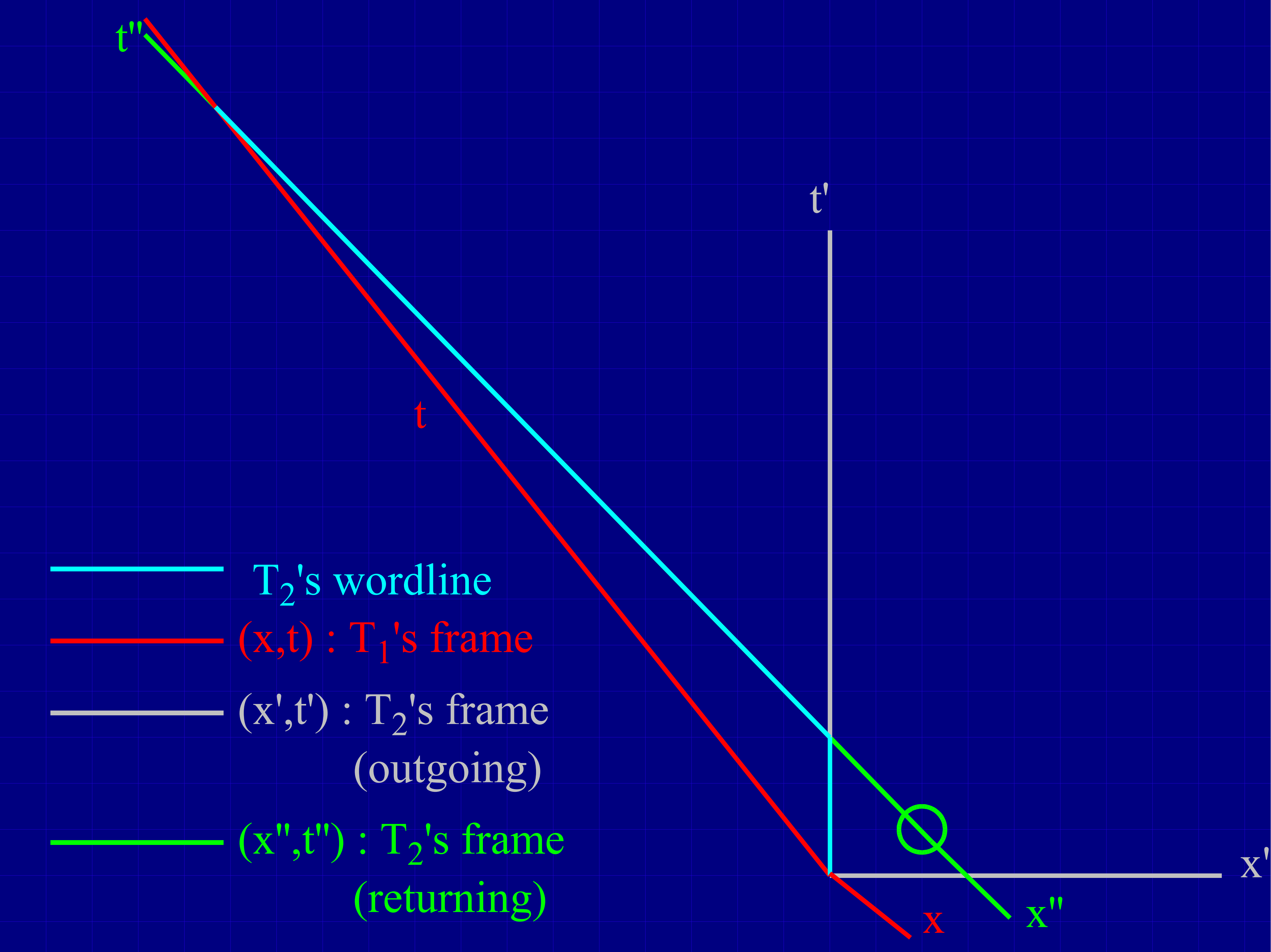
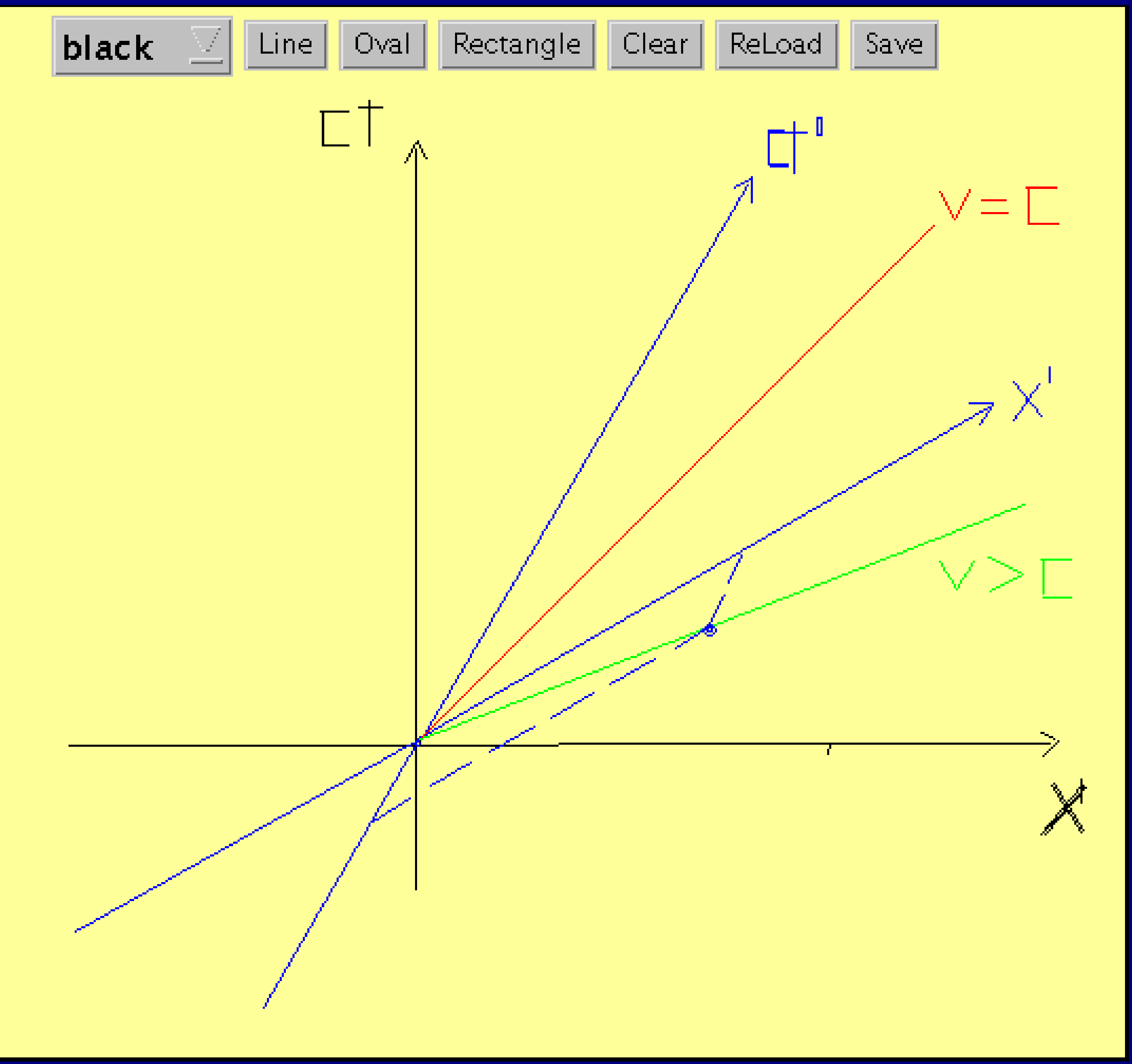


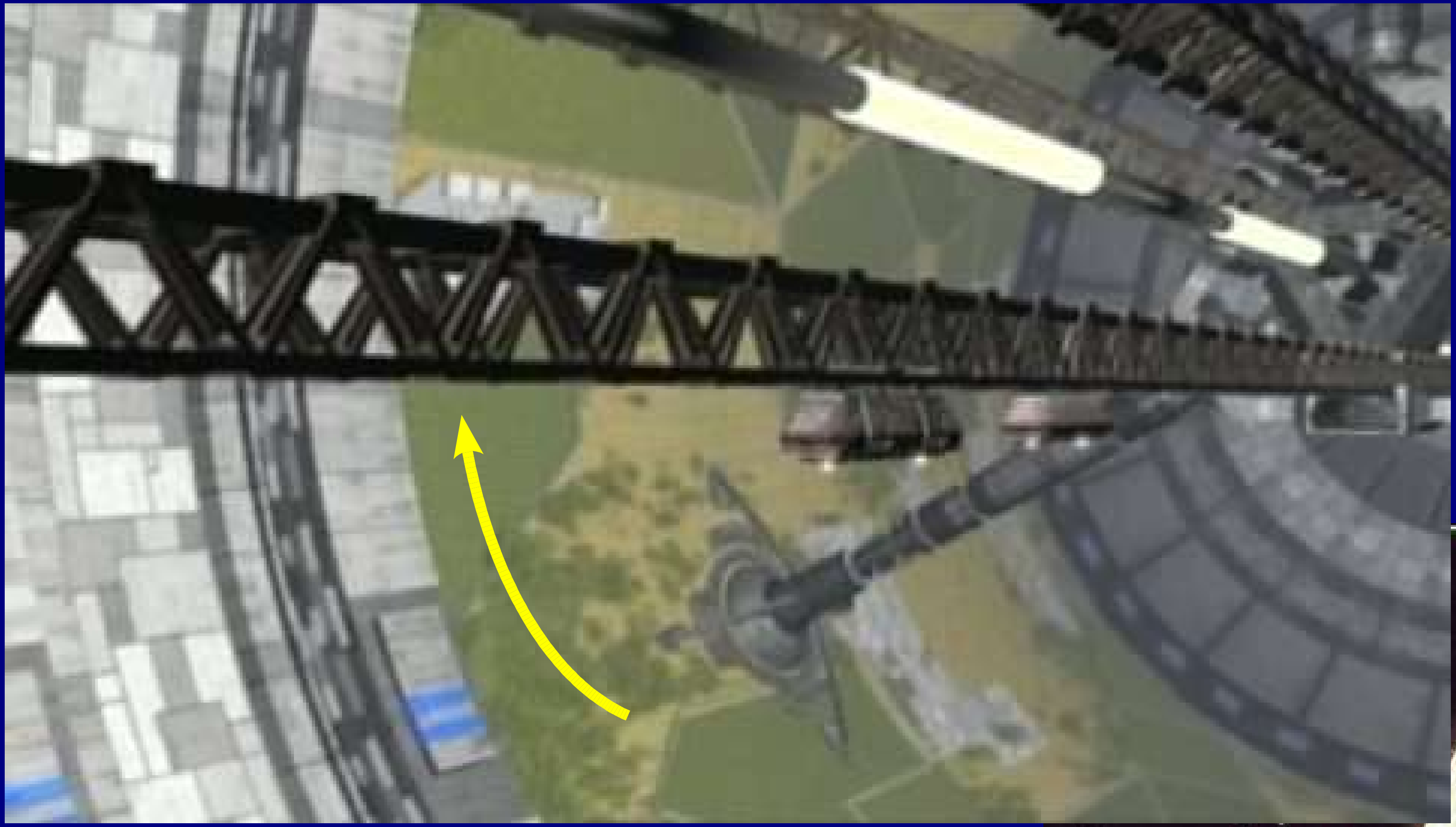
t''
t
t'
x'
x
x''
S1
S2b
S2a
T2's wordline
(x,t) : T1's frame
(x',t') : T2's frame (outgoing)
(x'',t'') : T2's frame (returning)

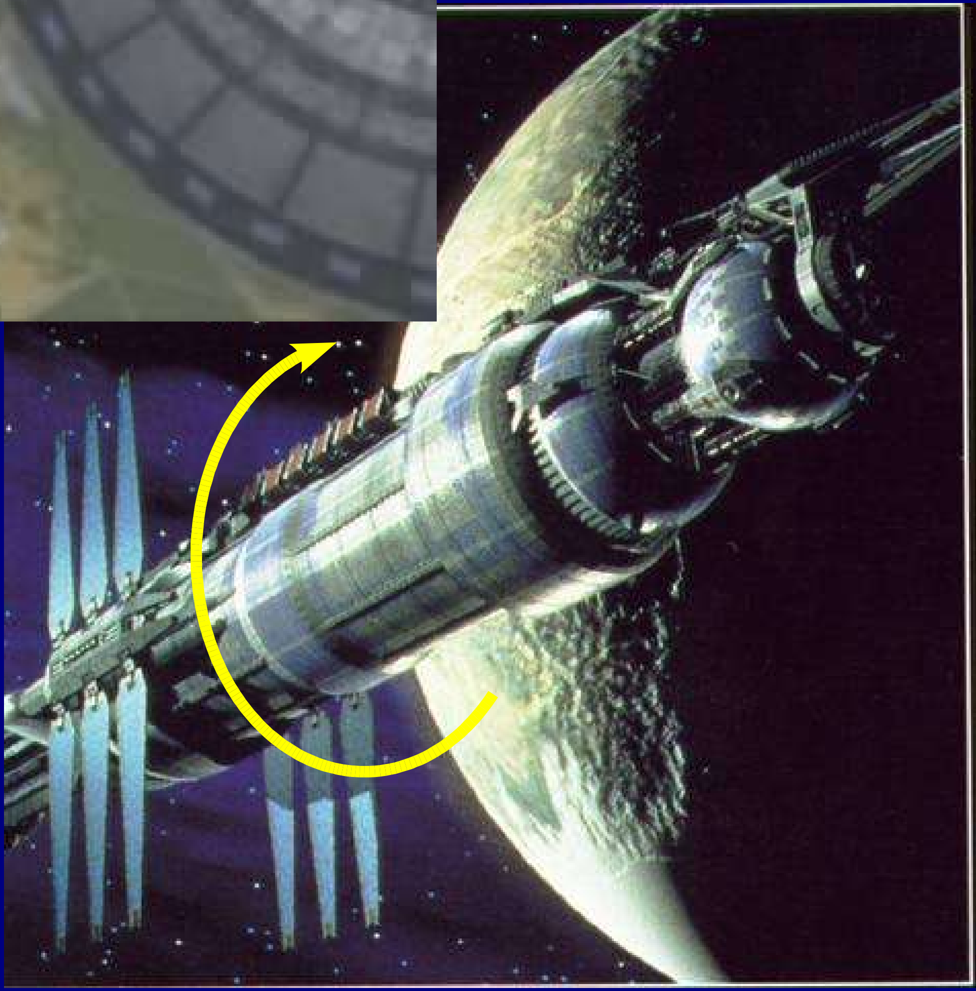

t''
t
t'
x'
x
x''
T2's wordline
(x,t) : T1's frame
(x',t') : T2's frame
(outgoing)
(x'',t'') : T2's frame
(returning)



The spacetime corresponding to the particle travelling faster than light is given in green. It is closer to the x-axis of our reference frame, an it still travels towards the "future".

It turns out that we can always pick one reference frame that is moving with respect to ours at a certain speed (smaller then the speed of light) in which the green particle travels towards the "past". It all comes from the geometry of the space.





Seems like the best method would just be to shine a dual directional laser light perpendicular to the surface of the station, a small distance above the floor. Assuming the station floor is smooth, the laser pulse should hit the floor on both sides of the laser. This indicates that the light is "bending" in this reference frame, showing that this "space" is curved. I don't see how Lorentz contraction has anything to do with measuring this

I would measure the length of an object at various radial distances from the center of the space station.

If the length changes as a function of the radial distance, then the space is curved.

I could measure the length of a rod in the radial and the tangential (moving) directions. In the first case I should basically get exactly the length of the rod in its rest frame, since no length contraction would occur on a direction normal to the direction of motion, whereas in the second case I would get a shorter length.

$$\frac{c}{r} > 2\pi$$