

During this interactive you are going to experiment with Einstein's simultaneity thought experiment, but with the ability to go even further.

1. What are the 2 postulates of Special Relativity?

---

---

---

---

Open the shortcut **IL Simul** on one of the lab stations.

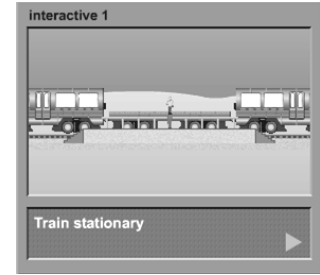
Do not open either of the simulation contained in this section, yet. **Do Not follow the directions in the simulation follow the following instructions.**

As discussed in class, lightning bolts strike each lightning rod. These lightning strikes cause flashes of light that will be visible to the observers. Photons – packets of light – move from the position of each lightning rod toward them. Each lightning strike counts as one of the two spatially separated events you are analyzing. The simulation draws the photons from one rod in blue, and the photons from the other rod in red, so that you can easily distinguish them. The lightning bolts also scorch the sides of the train as they hit the rods. The professor can use these scorch marks to confirm that the two events are equidistant from the train's center where he is standing.

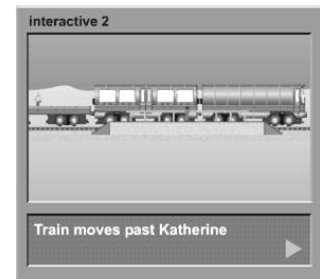
You will press GO to launch the lightning strikes. Use the PAUSE button to stop the simulation and confirm when the light arrives at the observers. A second press of the PAUSE button will restart the simulation. The simulations run in extreme slow motion. Time has been slowed down by a factor of more than fifty million to clearly show what is happening. The first simulation is in Katherine's reference frame. The second simulation starts in Katherine's reference frame. You can view the same events in the professor's reference frame by pressing the "Professor's reference frame" tab.

In order to let you experiment further with this thought experiment, both simulations contain a feature on the control panel that allows you to adjust the interval of time that Katherine observes between the lightning strikes. You can use this controller to see how she and the professor observe the events as this interval changes. For instance, you can cause there to be a five-nanosecond interval of time between when one photon reaches her and the next photon reaches her. This lets you go beyond Einstein's thought experiment, where the time interval in Katherine's reference frame was always zero and she observed the lightning strikes as occurring simultaneously.

2. Using the first simulation determine the distance the light poles are from Katherine. Do this by adjusting the time interval between the lightening strikes until the photons from one pole arrive at Katherine just as the lightening strikes the other pole. Use the PAUSE button to confirm that these two events happen simultaneously. **Show all work and equations including substitution with units.**



3. Using the second simulation determine the time interval in Katherine's reference frame between lightening strikes that causes the photons to arrive at the same instant at the professor's location. Do this by trial and error. Use the PAUSE button to confirm that the photons arrive simultaneously. This is easiest to see from the professor's frame of reference. Record all trials here, including units and the outcome of the trial.



4. What did Katherine observe during the last successful trial you did to answer question 3?

---

---

---

---