

[SQUEAKING]

[RUSTLING]

[CLICKING]

PROFESSOR: Welcome back to 820. So in this section, we want to define events and frames. The goal is to define the principle of relativity. So let's think first about what an event actually is. An event is something that happens, and it happens independently of the frame of reference, independently in how we want to describe the event itself. We might use the frame, the reference frame, to define the event. But again, the event is an independent thing which happens.

Let's look at an example, probably one of my favorite example in this class. Guess what happens? What? Professor Kloots exploded. Really? And then you start asking the questions, when and where. When did it happen, and where did it happen? But the event happens without a description of the when and where.

We can then draw a reference frame, as I did here, with an origin, with an x-coordinate, and a y-coordinate, and z-coordinate. And in this picture, we have a spot defined for the event. And we need to also have a fourth coordinate for this, the time, in order to describe when the event actually happened.

And I did this here. And some coordinates I give you. It's 42 degrees north, 75 degrees west, Cambridge, Massachusetts at MIT. You see, MIT, the dome behind me, at 3:30 PM on January 6, 2021. So I give you the when and the where for this event. I didn't give you the altitude, for example. This is, in this picture, maybe the y-coordinate or the z-coordinate. But that would be needed as well. I just tell you, maybe it's my office on the fourth floor in building 24.

So when we want to consider an event describing the event, we have to consider the space, so where, and the time, the when. And we can do this as a four dimensional vector or a four vector data set. And so our event, Professor Kloots exploded, can be described with this vector P , which has an x-coordinate, a y-coordinate, a z-coordinate, and a time coordinate.

So the important part here is that events happen independent on the frame of reference. If you are sitting in your room somewhere in Europe right now, you can describe this event with your time frame. There's a six hour time difference. So this 3:30 PM would be 9:30 PM in the evening.

You can define your little room as the origin and then draw an x-coordinate and a y-coordinate and z-coordinate that describes this specific event. This description will look different from the description I just gave you. But the event is unchanged. It's independent of the choice of reference.