[SQUEAKING]

[RUSTLING]

[CLICKING]

MARKUS KLUTE: Welcome back to 8.20, Special Relativity. In this section, you're going to take a journey through our solar system and beyond. 1977 marks the first flight of the Voyager program. Voyager is an MIT-led program with the original mission to study planetary systems.

Now, Voyager 1 and Voyager 2, two spacecrafts, are studying the interstellar space. Those two probes are still sending back now, more than 40 years later, information about measurement of their surroundings back to Earth. Those are the two furthest-away objects we were able to send.

What we have here in 8.20-- and it's IAP, so we are a little bit more ambitious-- our mission is to bring us to Alpha Centauri. Alpha Centauri is the closest star and planetary system to our solar system. It's actually not just one star, but multiple stars. And our journey brings us to Proxima B, which is a planet in the Alpha Centauri system.

So we have a very fancy spacecraft. It's able to travel with a constant velocity of 0.943 c, speed of light. The gamma factor is 3, and the path which it's going to take is 5 light years long. Alice is our ground control. She is going to stay on Earth. And Bob is going to take this journey with Virgin Galactic.

After some time, Bob is going to arrive on Proxima B. So your first challenge is to now calculate how long does this trip take from Alice's and Bob's perspective? So I ask you to stop the video here and just work this out.

So for Alice, the time needed is 5 light years divided by 0.9, by the velocity of 0.943, times the speed of light. And that gives us 5.3 years. So after 5.3 years, Alice is observing Bob's arrival on Proxima B. For Bob, the length of this path is Lorentz contracted-- 5 light years divided by 3, which is the gamma factor, which results to 1.67 light years. So for him, the journey takes only 1.77 years-- 1.67 light years divided by 0.943 times the speed of light.

So apparently, the time experienced by Alice and Bob for the very same journey is different. So this now is the first part, where we enter discussions of paradoxes in special relativity. And this will bring us, ultimately, to an understanding of the twin paradox later in this course.