

MARKUS

KLUTE:

Welcome back to 8.20, special relativity. So we're going to continue the discussion that makes a case against ether when discussing stellar aberration. So the problem we have in mind here is the ones where we use a telescope to look at a distant star. When we do this, the fact of ether might change the way we have to orient our telescope. Let's have a look at this.

So we are in a situation that our hypothesis is that the ether exists. This carries-- is the medium in which light travels. But it's dragged with earth. So this is our case number one.

In that situation, the telescope looks at the star. The light of the star enters our telescope at the top and then tries to go to the bottom. Because the medium in which the light travels and the telescope move with the same velocity-- remember, the ether is dragged with the earth-- the light appears to go straight down the telescope.

Without the-- [INAUDIBLE] case 2, without the ether being dragged or even exist, we actually do have to slightly tilt our telescope. Why? Because after the light hits the top of our telescope, the telescope keeps moving because it's in a different reference frame. And therefore, we have to have this slight tilting. The value of the tilt is equal to velocity of the Earth over C .

This is a well-known effect in astrophysics and, by the way, was already studied way earlier by James Bradley in the 1720s. He actually developed the-- not really supported theory of light where he was talking about particle nature of light. So his idea was very similar to case 2, that the Earth is moving in a different reference frame with respect to the star and the sun, moving around the sun.

And therefore, the tilting angle needs to be the tangent of the tilting and needs to be equal to the distance of Earth to the Sun. And the distance is [INAUDIBLE] this angle is very, very small because the nearest star [INAUDIBLE] to Earth is about four light years away.

So with this now, we can again do our ether versus particle nature model comparison. So in our first discussion, we concluded clearly that the wave and ether hypothesis dominates or wins. But now we have studied at least two further experiments.

So, again, I invite you to stop here and think about how stellar aberration and Michelson-Morley would be answers to the particle model or wave model [INAUDIBLE] explanation. As a thought experiment, the Fizeau and Airy experiment that we haven't and did not discuss this here.

All right. So for stellar aberration, the particle model actually seems to work, as it was proposed apparently to solve this very problem. And the Michelson-Morley experiment also is consistent with the particle model. So now we're in this dilemma that some experiments or experimental evidence for particle ether nature and some for the particle nature of light. So the question of how do we get out of the dilemma-- and we'll discuss this in [INAUDIBLE] the next section.