4. A rotating cylinder

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10 points

In 1908 Paul Ehrenfest proposed a paradoxal case to physicists who were working on the, then new, special theory of relativity. The problem gave birth to lots of discussion and inspired Albert Einstein to further develop his theory.

Ehrenfest had the following in mind:

A rigid body in the shape of a cilinder, height H, radius R and circumference O, $(O = 2\pi R)$, is initially at rest and is then put into a circular movement around it's axis. From a certain point the cilinder rotates with a constant angular speed. An observer who moves along with the cilinder will measure a radius R' and a perimeter O'.

1. What do you expect, according to the theory of special relativity, to be the ration between R' and O'.

2. What do you think is problematic in this particular case?

3. Try to give your own analysis on what's happening to the cylinder.