Relativity 1

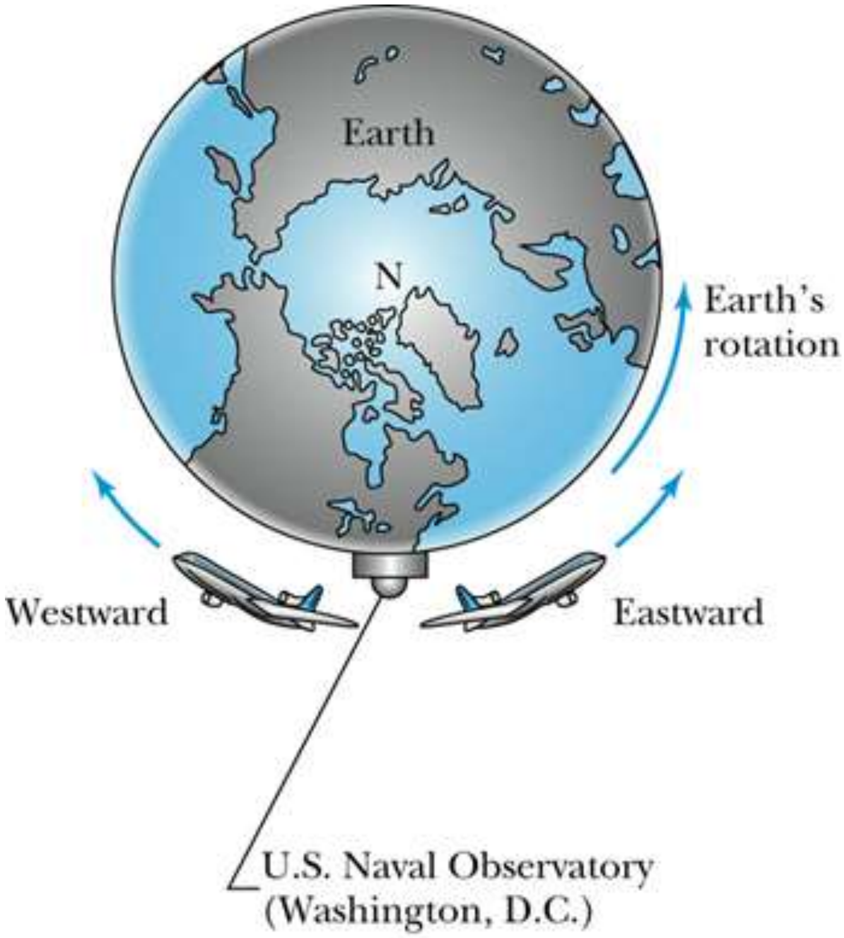
1. There were twins Jožo and Fero. Jožo has decided to be astronaut and boarded a cosmic space ship and flew away of the Earth with an average speed 0.8 times the speed of light (is this real? 😉). His brother Fero stayed at home. Both brothers have used timers (clocks) to measure the time of Jožo's stay in the space. After 60 seconds of the journey Jožo remembered his brother Fero. Try to calculate the time, which passed at the same moment on the Earth (on Fero's timer).

2. Certain physical process (e.g. Zeeman effect) requires 10^{-6} seconds to occur in an atom at rest in a laboratory. How much time will an observer measure, when the atom is moving with a speed $5 \cdot 10^{7}$ m/s?

3. Let's make a very simple computation of the time difference in the case of the Hafele-Keating experiment (1972). The average speed of the used aircraft was 656 mph = 1.055.72 km/h = 293.257 m/s and let us to assume that it was flying around the Earth along a meridian (over the poles) in an average height over the surface = 11 km (radius of the spherical approximation of the Earth is 6371 km). Calculate the time difference between the atomic clocks in the aircraft and on the Earth.

4. A space ship, 40 m long (e.g. Millenium Falcon from Star Wars) moves close to the Earth by the speed of 0.97c. What is the length of the ship, measured by an Earth-bound observer?

HW: Determine the relativistic time, if T_0 is given as 7 years and the speed of the object is given as 0.55c.


Earth
N
Earth's
rotation
Westward
Eastward
U.S. Naval Observatory
(Washington, D.C.)