62.2: Time Dilation

It turns out that one consequence of Einstein's postulates is that time runs more slowly for someone moving relative to you; this effect is called time dilation. If someone is moving at speed v relative to you, then their clocks will run slower than yours. If a clock measures a time interval Δt_0 when it's at rest, then when it's moving at a speed v relative to you, you will measure that time interval to be longer by a factor γ :

$$\Delta t = \gamma \Delta t_0, \tag{62.2.1}$$

where Δt is the time interval measured by the moving clock, Δt_0 is the time interval measured on the clock when it's at rest, and γ is an abbreviation for the factor

$$\gamma \equiv \frac{1}{\sqrt{1 - v^2/c^2}} \tag{62.2.2}$$

(Note that $\gamma \geq 1$.) The time interval Δt_0, measured when you're at rest with respect to the clock, is called the proper time.

This effect means that time travel is possible—at least time travel into the future. One simply builds a spacecraft and travels close to the speed of light, then turns around and returns to Earth. (It is not clear whether time travel into the past is possible, but it might be possible under Einstein's general theory of relativity.)