62.5: Momentum

In Newton's classical mechanics, momentum is $\mathbf{p} = m\mathbf{v}$. Under special relativity, this is modified to be

$$\mathbf{p} = \gamma m\mathbf{v}. \tag{62.5.1}$$

Relativistically, it is this definition of momentum that is conserved. Newton's second law in the form $\mathbf{F} = m\mathbf{a}$ is no longer valid under special relativity, but Newton's original form $\mathbf{F} = d\mathbf{p}/dt$ is still valid, using this definition of momentum $\mathbf{p}$.

Notice that as $v \to c$, we have $\gamma \to \infty$ (by Eq. 62.3.2), and so momentum $p \to \infty$. As a body goes faster, its momentum increases in such a way that it becomes increasingly difficult to make it go even faster. This means that it is not possible for a body to move faster than the speed of light in vacuum, c.