

In the article *A Momentum Paradox*, a simple device was presented. This device creates a paradox because Special Relativity does not provide techniques which can analyze the operation of many simple mechanisms. In this article, new experiments similar to the one in *A Momentum Paradox* will be presented. The momentums of these experiments will be calculated to see if these experiments obey the Law of Conservation of Momentum.

### Moving Mass Experiment

Figure 3 shows the first thought experiment.

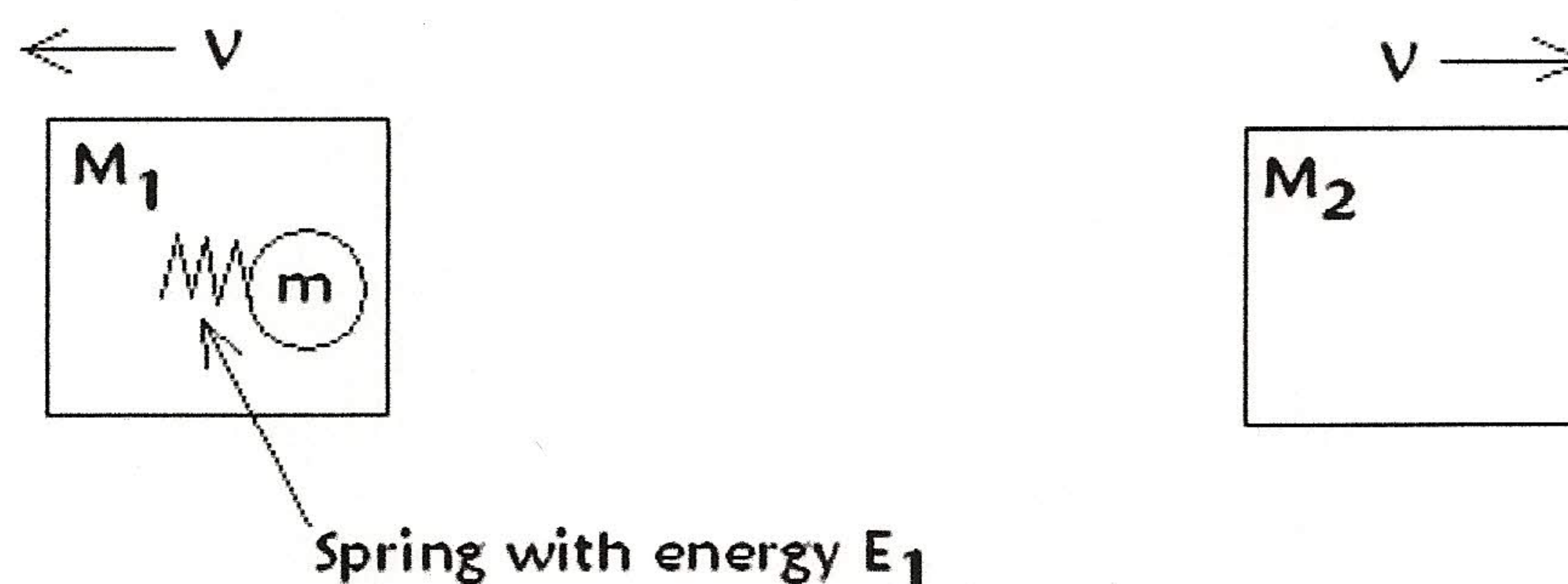


Figure 3. Starting position of Moving Mass experiment.

In Figure 3, two masses are moving with the velocities shown relative to our stationary inertial reference frame. The left mass  $M_1$  contains a smaller mass  $m$  and a spring that is compressed and contains energy  $E_1$ .

$$M_2 = M_1 + m + E_1 / c^2 \quad (4)$$

Under the condition (4), these two masses will have equal momentums relative to our observing reference frame (although these momentums are opposite in direction).

When the experiment starts, mass  $m$  will be sent by the spring toward mass  $M_2$ . If it's velocity is sufficient, it will run into  $M_2$  and will compress a spring inside of  $M_2$  (not shown). The energy in this spring will be  $E_2$  after compression.

The first part of the experiment will be analyzed from a reference frame that is traveling to the left at speed  $V$ . See Figure 4, where all of the spring energy has been expended and mass  $m$  has a velocity to the right.



Figure 4. Left reference frame view after mass  $m$  has been pushed by the spring.

It must be assumed that the Law of Conservation of Momentum applies for the event depicted in Figure 4. The spring energy has been converted into kinetic energy of the two masses and does not contribute to the momentum calculation.

$$\frac{M_1 V_{1L}}{\sqrt{1 - \frac{V_{1L}^2}{c^2}}} = \frac{m v_L}{\sqrt{1 - \frac{v_L^2}{c^2}}}$$

$$V_{1L} = \frac{-c}{\sqrt{1 + \frac{M_1^2}{m^2} \left( \frac{c^2}{v_L^2} - 1 \right)}} \quad (5)$$

In (5),  $V_{1L}$  has been made negative to indicate its direction. Any velocity  $v_L$  can be chosen for  $m$  and the corresponding velocity for  $M_1$  can be found from (5). To observe the event where  $m$  runs into mass  $M_2$ , a reference frame traveling at speed  $V$  to the right is chosen. See Figure 5.



Figure 5. Right reference frame view of mass  $m$  before it collides with  $M_2$ .

