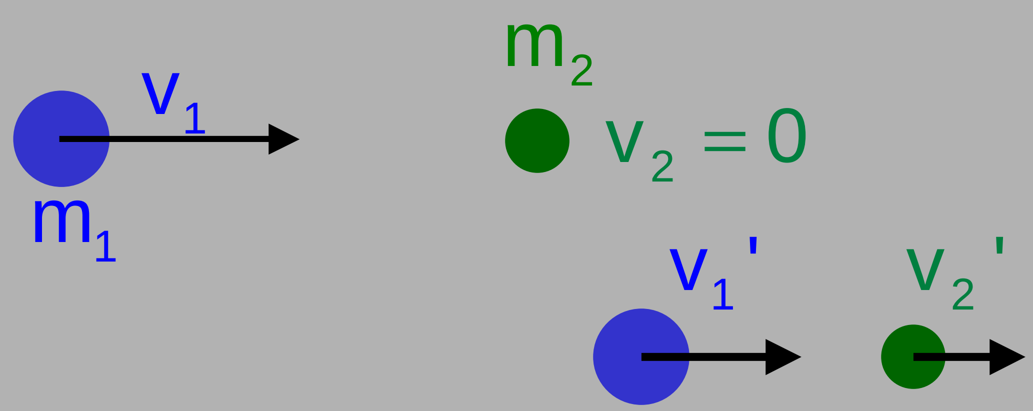
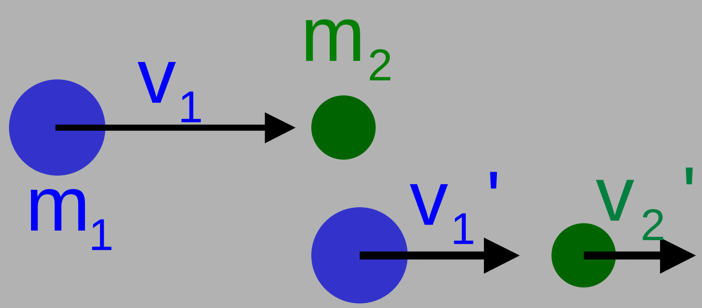
Der vollkommen elastische Stoß



	Gesamtenergie	Gesamtimpuls
Vor dem Stoß	$E = \frac{1}{2} m_1 v_1^2$	$\vec{p} = m_1 \vec{v_1}$
Nach dem Stoß	$E' = \frac{1}{2} m_1 v_1'^2 + \frac{1}{2} m_2 v_2'^2$	$\vec{p'} = m_1 \vec{v_1'} + m_2 \vec{v_2'}$

Der vollkommen elastische Stoß



$$\frac{1}{2}m_1v_1^2 = \frac{1}{2}m_1v_1'^2 + \frac{1}{2}m_2v_2'^2$$

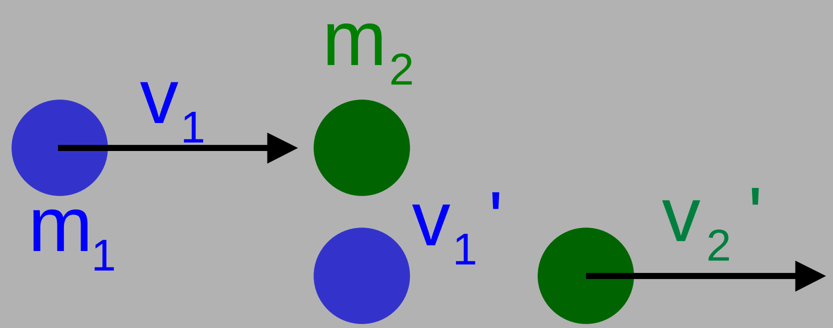
$$m_1v_1 = m_1v_1' + m_2v_2'$$

Lösung:

$$v_1' = \frac{m_1 - m_2}{m_1 + m_2}v_1 \qquad v_2' = \frac{2m_1}{m_1 + m_2}v_1$$

Der vollkommen elastische Stoß : $m_1=m_2$

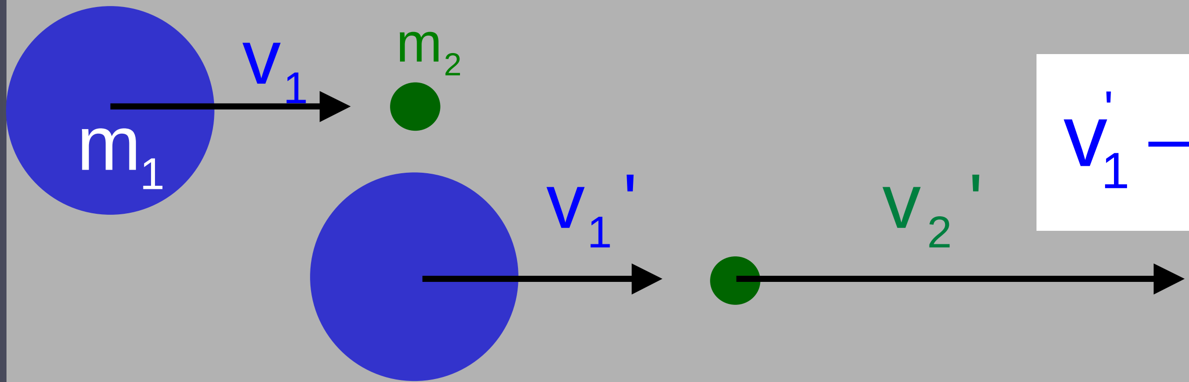
$$v_1' = \frac{m_1 - m_2}{m_1 + m_2} v_1 \qquad v_2' = \frac{2m_1}{m_1 + m_2} v_1$$



$$v_1' = 0 \qquad v_2' = v_1$$

Der vollkommen elastische Stoß : $m_1 >> m_2$

$$v_1' = \frac{m_1 - m_2}{m_1 + m_2} v_1 \qquad v_2' = \frac{2m_1}{m_1 + m_2} v_1$$

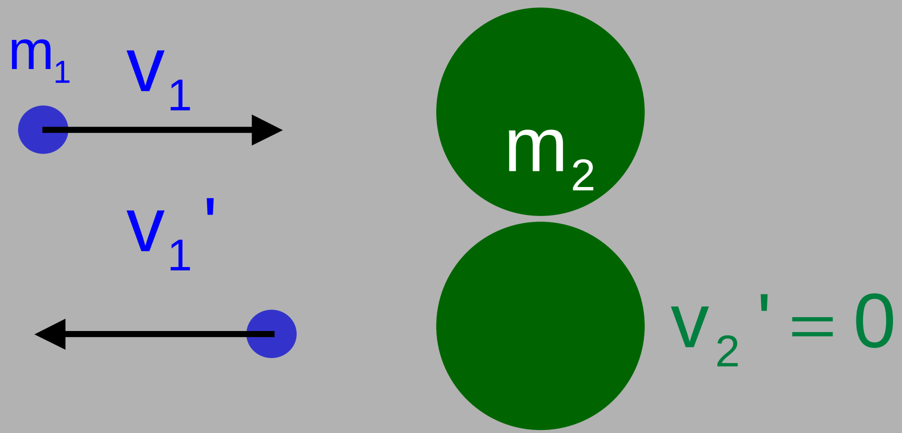


$$v_1' \rightarrow v_1 \qquad v_2' \rightarrow 2v_1$$

$$v_1' = \frac{m_1 - m_2}{m_1 + m_2} v_1 = \frac{1 - \frac{m_2}{m_1}}{1 + \frac{m_2}{m_1}} v_1 \qquad v_2' = \frac{2m_1}{m_1 + m_2} v_1 = \frac{2}{1 + \frac{m_2}{m_1}} v_1$$

Der vollkommen elastische Stoß : $m_1 << m_2$

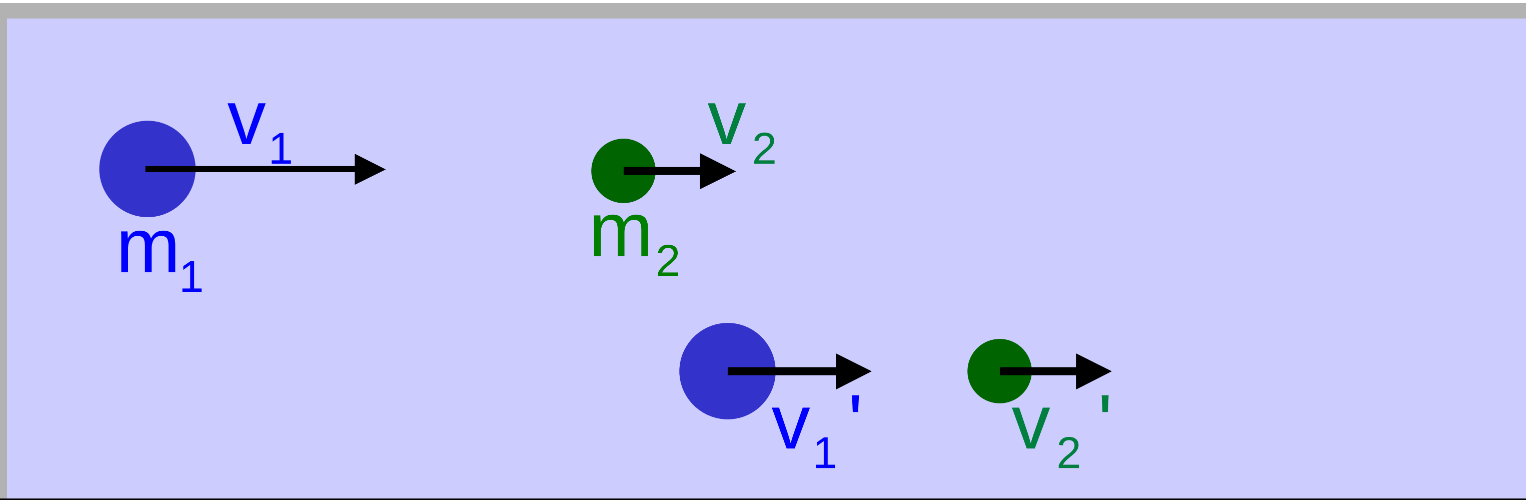
$$v_1' = \frac{m_1 - m_2}{m_1 + m_2} v_1 \qquad v_2' = \frac{2m_1}{m_1 + m_2} v_1$$

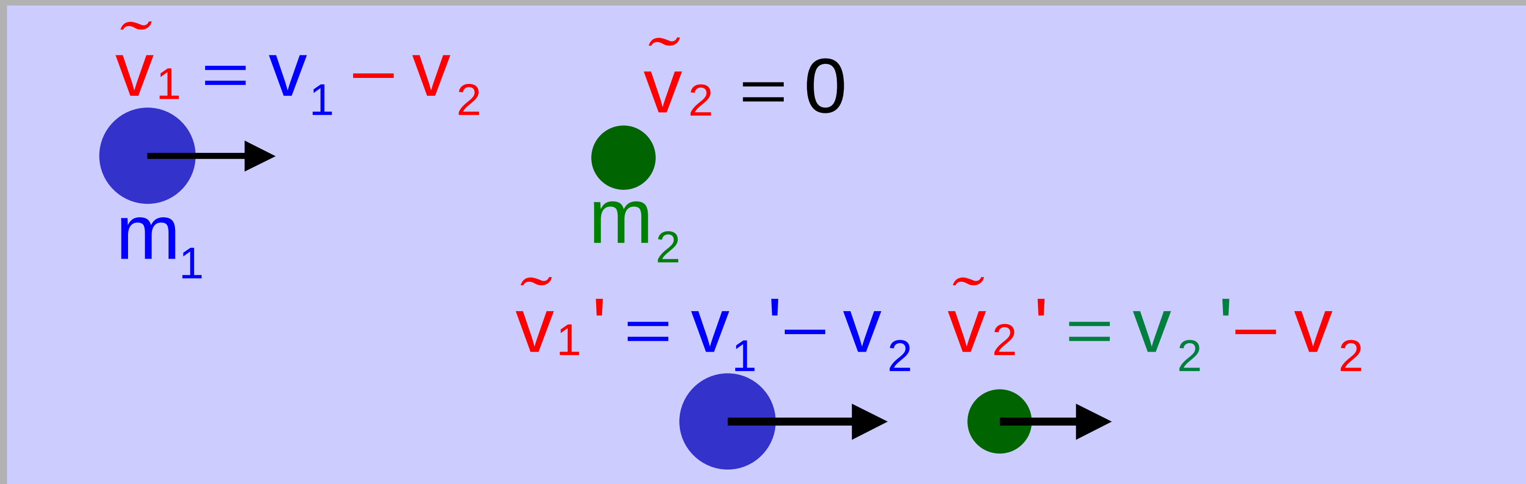


$$v_1' \rightarrow -v_1 \qquad v_2' \rightarrow 0$$

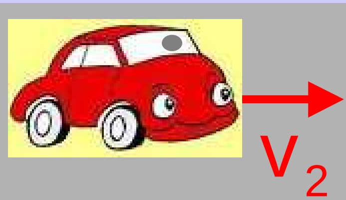
$$v_1' = \frac{m_1 - m_2}{m_1 + m_2} v_1 = \frac{\frac{m_1}{m_2} - 1}{\frac{m_1}{m_2} + 1} v_1 \qquad v_2' = \frac{2m_1}{m_1 + m_2} v_1 = \frac{2\frac{m_1}{m_2}}{\frac{m_1}{m_2} + 1} v_1$$

Der vollkommen elastische Stoß

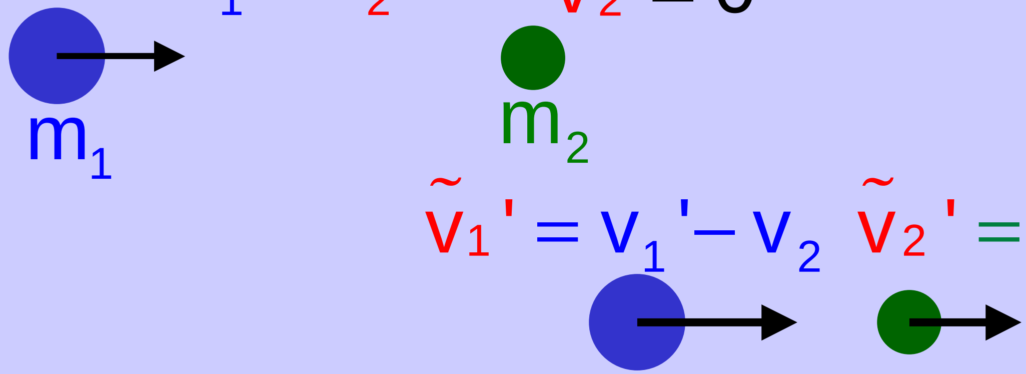




Anderes Bezugssystem



Der vollkommen elastische Stoß



$$\tilde{v}_1 = v_1 - v_2 \qquad \tilde{v}_2 = 0$$

m_1 $\qquad$ m_2

$$\tilde{v}_1' = v_1' - v_2 \qquad \tilde{v}_2' = v_2' - v_2$$

$$\tilde{v}_1' = \frac{m_1 - m_2}{m_1 + m_2}(v_1 - v_2) \qquad \tilde{v}_2' = \frac{2m_1}{m_1 + m_2}(v_1 - v_2)$$

$$v_1' = \tilde{v}_1' + v_2 = \frac{m_1 - m_2}{m_1 + m_2}(v_1 - v_2) + \frac{m_1 + m_2}{m_1 + m_2} v_2$$

$$= \frac{2m_2 v_2 + (m_1 - m_2) v_1}{m_1 + m_2}$$

Der vollkommen elastische Stoß

$$\tilde{v}_1' = \frac{m_1 - m_2}{m_1 + m_2}(v_1 - v_2) \qquad \tilde{v}_2' = \frac{2m_1}{m_1 + m_2}(v_1 - v_2)$$

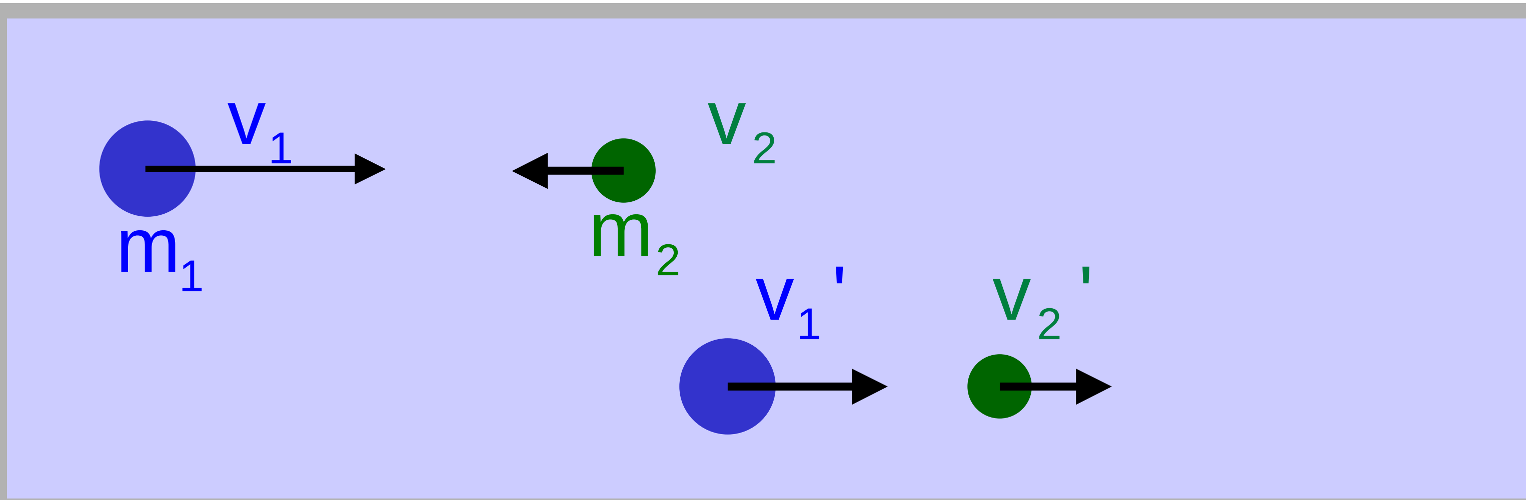
$$v_1' = \tilde{v}_1' + v_2 = \frac{m_1 - m_2}{m_1 + m_2}(v_1 - v_2) + \frac{m_1 + m_2}{m_1 + m_2} v_2$$

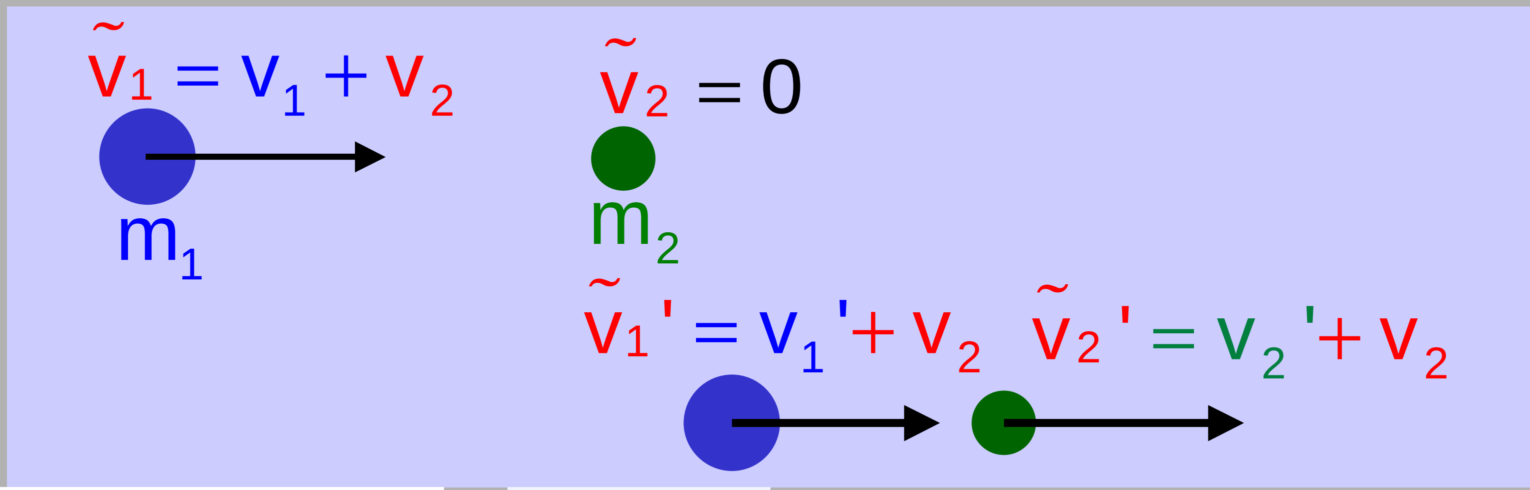
$$= \frac{2m_2 v_2 + (m_1 - m_2) v_1}{m_1 + m_2}$$

$$v_2' = \tilde{v}_2' + v_2 = \frac{2m_1}{m_1 + m_2}(v_1 - v_2) + \frac{m_1 + m_2}{m_1 + m_2} v_2$$

$$= \frac{2m_1 v_1 + (m_2 - m_1)}{m_1 + m_2} v_2$$

Der vollkommen elastische Stoß





Anderes Bezugssystem

v_2

Der vollkommen elastische Stoß

$$\tilde{v}_1' = \frac{m_1 - m_2}{m_1 + m_2}(v_1 + v_2) \qquad \tilde{v}_2' = \frac{2m_1}{m_1 + m_2}(v_1 + v_2)$$

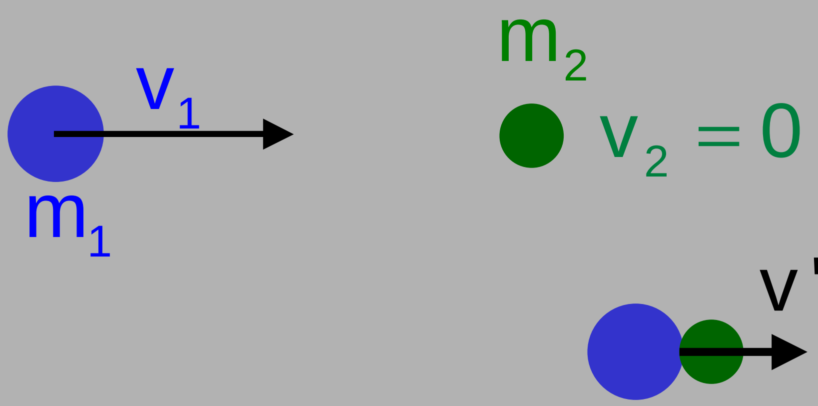
$$v_1' = \tilde{v}_1' - v_2 = \frac{m_1 - m_2}{m_1 + m_2}(v_1 + v_2) - \frac{m_1 + m_2}{m_1 + m_2} v_2$$

$$= \frac{-2m_2 v_2 + (m_1 - m_2) v_1}{m_1 + m_2}$$

$$v_2' = \tilde{v}_2' + v_2 = \frac{2m_1}{m_1 + m_2}(v_1 + v_2) + \frac{m_1 + m_2}{m_1 + m_2} v_2$$

$$= \frac{2m_1 v_1 + (m_2 - m_1)}{m_1 + m_2} v_2$$

Der vollkommen elastische Stoß



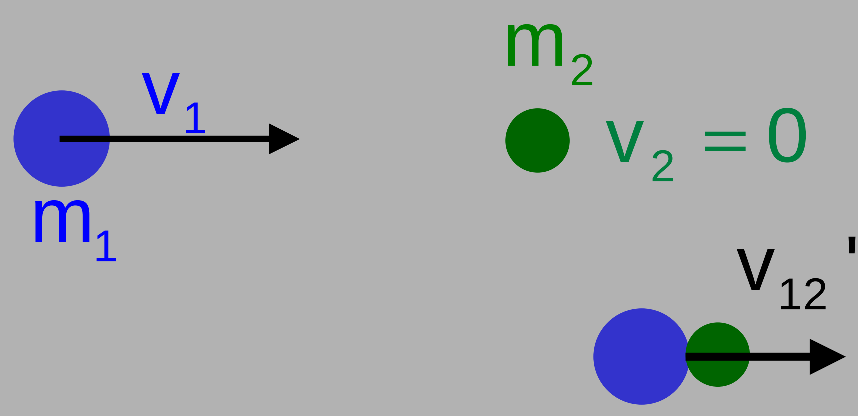
$$\frac{1}{2}m_1 v_1^2 = \frac{1}{2}(m_1 + m_2)v'^2 + E_i$$

$$m_1 v_1 = (m_1 + m_2)v'$$

Lösung:

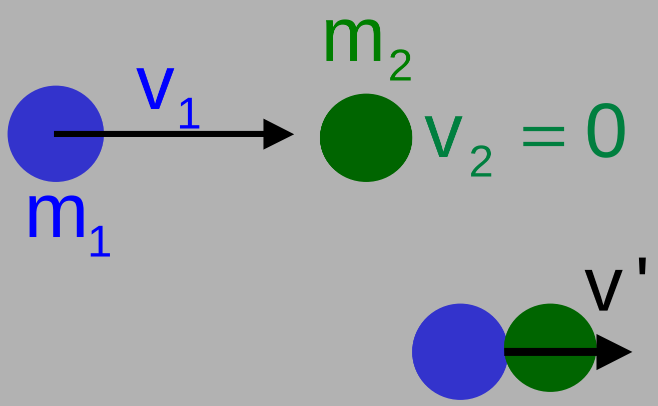
$$v' = \frac{m_1}{m_1 + m_2} v_1 \qquad E'_i = \frac{1}{2} \cdot \frac{m_1 \cdot m_2}{m_1 + m_2} v_1^2$$

Der vollkommen elastische Stoß



	Gesamtenergie	Gesamtimpuls
Vor dem Stoß	$E = \frac{1}{2} m_1 v_1^2$	$\vec{p} = m_1 \vec{v_1}$
Nach dem Stoß	$E = \frac{1}{2}(m_1 + m_2) v_{12}'^{\,2}$	$\vec{p'} = (m_1 + m_2)\vec{v_{12}'}$

Der vollkommen elastische Stoß : $m_1=m_2$

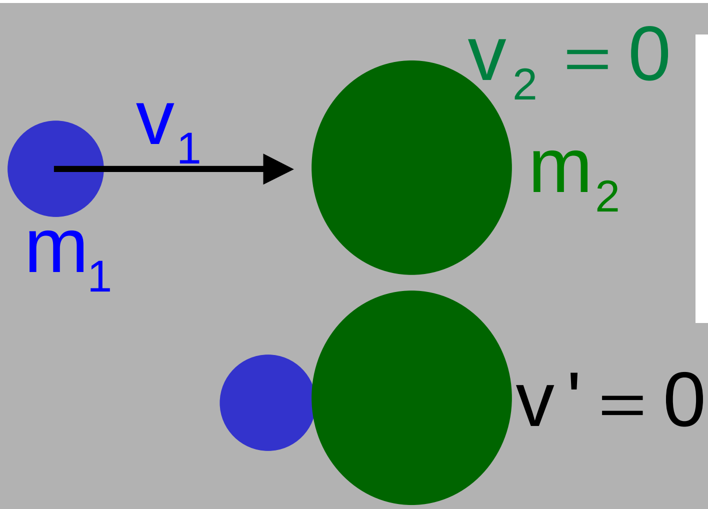


$$v' = \frac{m_1}{m_1+m_2} v_1 \qquad E_i = \frac{1}{2} \cdot \frac{m_1 \cdot m_2}{m_1+m_2} v_1^2$$

Lösung:

$$v' = \frac{1}{2} v_1 \qquad E_i = \frac{1}{4} \cdot m_1 v_1^2 = \frac{1}{2} \cdot E_{kin1}$$

Der vollkommen elastische Stoß : $m_1 << m_2$

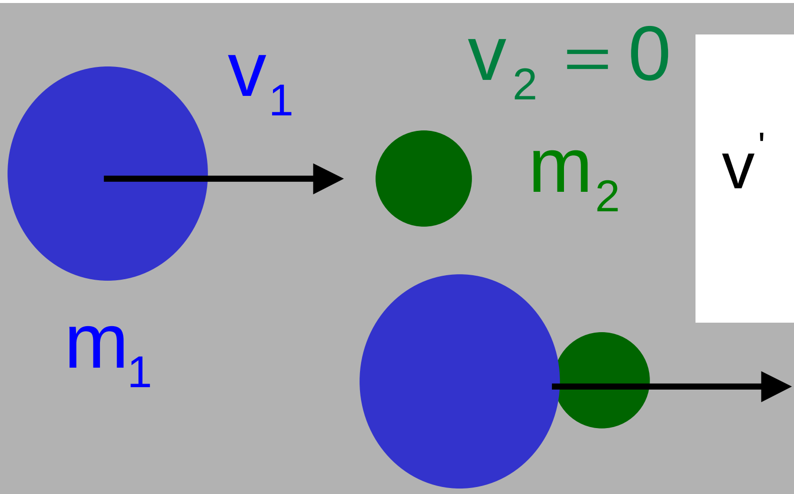


$$v' = \frac{m_1}{m_1 + m_2} v_1 \qquad E_i = \frac{1}{2} \cdot \frac{m_1 \cdot m_2}{m_1 + m_2} v_1^{\,2}$$

Lösung:

$$v' \to 0 \qquad E_i = \frac{1}{2} \cdot m_1 v_1^{\,2} = E_{kin1}$$

Der vollkommen elastische Stoß : $m_1 >> m_2$



$$v' = \frac{m_1}{m_1 + m_2} v_1 \qquad E_i = \frac{1}{2} \cdot \frac{m_1 \cdot m_2}{m_1 + m_2} v_1^2$$

$$v' \to v_1$$

Lösung:

$$v' \to v_1 \qquad E_i \to \frac{1}{2} \cdot m_1 v_1^2 = E_{kin1}$$