The roots of quantum mechanics are in relativity.

Relativistic velocity transform: Frame $S'$ moves right at $V$ for the special case $u_x' = 0$

$u_x = \frac{u_x'}{\gamma}$, $\gamma = \frac{1}{\sqrt{1-v^2/c^2}}$

This means "we showed that" $u_y = \frac{u_y'}{\gamma}$ as seen in $S'$

$u_y$ - component of velocity of ball as seen in $S'$

Relativistic momentum

Consider symmetric elastic collision of two identical balls.

$U_A y' = U_0$

$U_B y' = -U_0$

In $S$

$U_A y = U_0$

Because of the symmetry of this situation, we know that the collision simply reverses the $y$-component of the velocity of each ball.

$U_y = \frac{U_y'}{\gamma} \rightarrow$ If we define $\vec{p} = m\vec{u}$, then momentum is not conserved.!!