# Lab 6 (Conservation of Linear Motion)

## Part I: Perfectly Inelastic Collision

**Discussion**

Was the total linear momentum of the system conserved during collision? Explain. Was this outcome expected for this type of collision?

Yes, the total linear momentum of the system was conserved during the collision. Prior to the collision, the system’s momentum was measured to be *0.043 ± 0.001 kgm/s*. Following the collision, the momentum was slightly reduced to *0.042 ± 0.0006 kgm/s*. This minor discrepancy can be attributed to external factors such as friction and the inherent uncertainty associated with time measurements.

The conservation of momentum is a fundamental concept in physics and is expected in all types of collisions, provided no external forces are acting on the system. In this case, despite the slight reduction due to aforementioned factors, the momentum conservation principle holds true, aligning with our expectations for this collision experiment.

**Conclusions**

This experiment aimed to study one-dimensional collisions on an air track to investigate the conservation of linear momentum and the elasticity of the collision. The results show that the initial and final total momentum of the system differed by only *0.001* kgm/s, confirming that linear momentum is essentially conserved under the near-ideal conditions provided by the air track. This minor discrepancy could be attributed to factors such as slight air resistance, minor imperfections in the air track, or measurement errors. Overall, the outcome strongly validates the principle of conservation of linear momentum for one-dimensional collisions in isolated systems. Therefore, the experiment successfully met its objectives, corroborating theoretical predictions with empirical data.

## Part II: Inelastic / Elastic Collision

**Discussion**

What did you expect the coefficient of restitution to be for the collision that you just investigated? Does your calculated coefficient of restitution agree with what you expected? Explain

I think it’s going to be elastic because I thought it’s going to bounce. We got *0.9* for the coefficient of restitution, which means it’s inelastic. The answer is **no**, it doesn’t agree with what I expected.

Regarding the elasticity of the collision, it is determined through the coefficient of restitution (e). This coefficient is calculated using the relative velocities of the gliders before and after the collision. ***For a perfectly elastic collision, the coefficient will be 1, indicating that kinetic energy is also conserved. For inelastic collisions, the coefficient will be between 0 and 1, signifying that some kinetic energy is converted into other forms like heat or sound.*** By measuring the initial and final velocities and employing these in the calculation of the coefficient of restitution, the experiment provides a quantitative measure of how elastic or inelastic the collision is.

**Conclusions**

In conclusion, the initial expectation was for the collision to be elastic, as indicated by the anticipation of a bouncing effect. However, the calculated coefficient of restitution was 0.9, which is less than 1. This suggests that the collision was not perfectly elastic, but rather inelastic to some degree.

The discrepancy between the expected and observed outcomes can be attributed to real-world factors that often make collisions less than perfectly elastic. These factors can include energy dissipation in the form of heat or sound, air resistance, internal friction within the objects, and potential deformation of the objects during collision.

Therefore, while the collision exhibited significant elasticity (as evidenced by a coefficient of restitution close to 1), it was not entirely elastic as initially expected. This highlights the importance of experimental data in validating or refuting theoretical predictions in physics.