Background

- During the early stages of the Solar System, a swirling nebula of gas and sub-mm dust was transformed into objects such as planetesimals that we observe today.

- In these stages of transformation, growth as a result of pairwise collisions is no longer effective when objects reach cm-sized pebbles due to growth barriers. While growth to planetesimal sizes (1 km - 100 km) can occur via gravitational collapse.

Objectives

- Vary the initial random velocities to consider the influence of turbulent mixing in the protoplanetary disk.

- Analyze how these independent variables affect the efficiency of planetesimal accretion, including the final mass converted into planetesimals.

- The number of accreted planetesimals, and the multiplicity of planetesimal systems (binary, ternary, etc.).

- Compare these binaries to that of the cold classical Kuiper Belt Binaries.

Methods

Results

![Figure 1](image1.png)

**Figure 1**

Comparing the Binary Mass Ratios against the Random Velocities. Here we have 10 run's (lighter shades) averaged into a singular trend (darker shades).

![Figure 2](image2.png)

**Figure 2**

Comparing the Binary Mass Accretion Efficiency against the Random Velocities. Here we have 10 run's (lighter shades) averaged into a singular trend (darker shades).

Conclusions and What’s Next

- In Figure 1, we noticed a decrease in higher rates, but as it got closer, it increased to establish a limit at a speed of about 1.50 (m/s).

- Looking at Figure 2, Binary Accretion Efficiency and noticed that the sharp decline we see happened at much higher random velocities than expected. This decline reaches a limit at higher velocities, around 1.50 (m/s).

- Onto Figure 3, when looking at the primary and secondary mass, the growth starts to be exponential, and then it plateaus as anticipated.

- Finally, we hope to do further energy analysis on this system to see the distribution of total energy of the particles over time to see the effects of our system even further.

![Figure 3](image3.png)

**Figure 3**

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