THE MECHANICS OF BINARY INTERACTIONS

Our system consists of $N \to \infty$ mechanically identical, spherical particles of masses m_1 and diameters σ_1. We call them monomers. These monomers can interact gravitationally, though their masses are very small. When monomers collide with each other, they lose certain amount of the impact energy and rebound with a coefficient of restitution ε. If the impact energy is less than a certain threshold value $E_{\rm imp} \leqslant E_{\rm agg}$, the monomers stick to each other due to surface forces, such as van der Waals forces, and an aggregate particle of mass m_2 and diameter σ_2 appears. We call this process *aggregation*. The aggregation process is a mechanism that creates larger particles from constituent monomers. On the other hand, there is also a mechanism which decreases the sizes of aggregates, which we call *fragmentation*. If the impact energy is larger than a certain threshold value $E_{\rm imp} \geqslant E_{\rm frag}$, then the colliding aggregates break into smaller pieces.

Collision mechanics

We consider a collision of two particles of masses m_i, m_j, and velocities $\boldsymbol{v}_i$, $\boldsymbol{v}_j$. If the particles did not exert gravitational influence, the collision geometry would have been a linear problem. However, the gravitational interaction of the particles result in a deflection of the trajectories of motion, aka *gravitational stirring*.

Aggregation mechanics