

Lecture 1, Sep 7, 2023

- *Postulate of Space*: physical space is represented by a 3-dimensional Euclidean space
- *Particle*: a quantity of matter that occupies an infinitesimal volume
- *Postulate of Time*: there exists the dimension of time, same regardless of space, and a particle can only be in one position at one time; changes in position are continuous in space and time
- *Law of Inertia*: there exists a frame of reference in which an isolated particle moves in a straight line in any direction (note we don't yet say the motion is uniform)
 - Such frames where the Law of Inertia holds are *inertial reference frames*
 - *Mach's Principle*: a local inertial frame is determined by all the matter in the universe and its distribution
- An isolated particle in an inertial reference frame moves equal intervals of distance in equal intervals of time; this is how we will define a graduation of time
- *Law of Action and Reaction*: the accelerations of two isolated particles in an inertial reference frame are in mutually opposite directions and the ratio of their magnitudes is constant
 - This allows us to define *ratio of masses* m_i to m_j is such that $m_i a_i = -m_j a_j$, but not absolute mass directly
- *Postulate of the Transitivity of Mass*: for any 3 particles, $\mu_{ij}\mu_{jk}\mu_{ki} = 1$ where μ_{ij} is the ratio of the mass of particle i to j
- *Total Force*: the total force \underline{f} on a particle of mass m is $\underline{f} = m\underline{a}$
 - The *individual force* comes only from a single agent
 - Newton's second law becomes a definition for force
 - *Law of Superposition of Forces*: the total force on a particle is the vector sum of the individual forces