

PHYSICS

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In this third volume of the MCFA Annals the papers of the physics section address topics situated at two different extremes of our world.

Two of our contributions are focused on the magnetic and structural properties of crystalline materials and their fundamental impact on the development of devices we use in everyday life. The scales over which theoretical models attempt to reproduce the physical world are just over a few billionths of a meter. Over those tiny scales physics is dominated by the electromagnetic forces in a highly complex manner and statistical mechanics describes the global properties and disorder of the materials.

A leap of 20 orders of magnitude from the microscopic scales of the atoms to the orbits of near earth asteroids in our solar system brings Newton's law and gravity into the forefront. Even though gravity is nearly 40 orders of magnitude "weaker" than the electromagnetic forces the fact that it is much easier to accumulate large quantities of matter rather than large electric charges makes gravity the ultimated force that shapes the future of our Universe.

Unfortunately though lack of determinism, complexity, and chaos do enter this regime as well. New numerical techniques and theoretical approaches need to be developed in order to be able to see into the distant future whether a near earth asteroid will actually cross the orbit of the earth around the sun at the time the earth occupies the same location...