Many body system, Strong connection, Ionic plasma(symposium)

Chihiro Kaito[1]

[1] Ritsumeikan Univ.

Laboratory studies on the interaction between dust and plasma field
C. Kaito (Ritsumeikan Univ.)

In our universe, plasmas interact with solid matter of different sizes; small dust particulates dispersed inside the ionized gas or moving solid bodies as planets, moons, meteorites, comet nuclei or asteroids. Dusty plasmas in space exist in various environments such as interstellar clouds, circumsteller envelopes, cometary tails, planetary rings, circumsteller and protoplanetary accretion disks. Changing of dust grains inside plasma and consequences on the plasma dynamics and on its interaction with currents and fields is of fundamental importance to understand main process occurring in space. Small dusts less than 1 um in size can be produced by the gas evaporation technique in which a material is heated in an atmosphere without any substrate in many cases, they form three-dimensional solid dusts from the gas phase, Vapor from the heated material is subsequently cooled and condensed in inert gas atmospheres, resulting in smoke which resembles the flame of a candle. The smoke experiments on metallic dusts were initiated in Japan in 1963 by stimulation of solid state physics in clusters or ultrafine particles. In the growth of smoke dusts, the coalescence growth which is based on the solid-solid reaction among colliding particles were most primary important mechanism. The dusts concerned in astrophysics interest were not always produced by the direct evaporation method, because the direct evaporation of materials was not always given by the same compound of the evaporated material. On the other hand, the infrared space observatory (ISO) significantly changed our view of the silicates present in space when crystalline phases were discovered in space. Both olivine and enstatite crystals were observed. It was a problem that iron-rich Silicates were newer observed. In the present report, we show recent results on the plasma field effect in the smoke. The iron- rich silicate formation is only produced by the existence of the plasma field. Therefore probability of the ion-rich silicates dust formation in space is low. On the other hand, discoveries of absorption hung at 217.5 nm and infrared emission / absorption bands opened a material science in astronomy. A brown- black material produced in Japan which called dark -QCC formation from the plasmic gas of CH_4 will be shown, because it have the first successfully results on the formation of dust in plasma.

The basic physics of gravitational many-body systems
H. Kokubo (National Astronomical Observatory of Japan)

In astronomy, star clusters such as open clusters, globular clusters, and galaxies are well approximated as a gravitational many-body system, where the system evolves through gravitational interaction among constituent stars. The dynamics of a gravitational many-body system is similar to that of ionized gas in many aspects, since in both systems the force between particles obeys the inverse-square law. Here, we review the basic physics of a gravitational many-body system.

Recent Progress in ion trapping, ionic plasmas and matters
R. Hatakeyama (Tohoku Univ.)

Ionic condensed matter' points to 'strongly Coulomb-coupled' high-density systems in the universe, daily products and biological environments, covering from white dwarfs, metallic hydrogen, dusty plasmas, and 'ionic soft matter' such as polymers, colloids, DNA, proteins, and water. In the latter, ions of the equal charge sign can aggregate, or a highly charged particle can be inversely charged in the presence of multivalent counterions. Recent progress in the 'ion trapping' study advances the production of 'highly-charged' and hydrogenated-silicon 'cluster ions' applicable to X-ray laser, lithography, and optics. A 'pair-ion plasma' of equal-mass ions is found to display unique collective phenomena.