"Some Studies on Regular and Chaotic Motions of Satellites"

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In the thesis, we have studied "Some Studies on Regular and Chaotic Motions of Satellites". Here, we have considered the effect of Gravitational, tidal, magnetic and Solar radiation forces in the motion of a satellite. These forces play very important role and act as perturbing elements of the orbit of the satellite. The physical model of equation of motion is generally quite helpful for investigating the motion of natural satellite. However, it makes possible for finding the qualitative features and trends of the influence of dissipative factors for the artificial satellite. In the present work, we have studied ten satellites: Mimas, Enceladus, Tethys, Dione, Rhea, Titan, Hyperion, Amalthea, Janus, Phobos for the role of Gravitational, tidal, magnetic and Solar radiation pressure parameters. These satellites are only taken as models, there is no special significance attached to their choice. We have studied the motions when Gravitational, tidal, magnetic, Solar radiation force are together in action, where we have considered limiting range of β, tidal parameter, as given in Sharma et al. (1998), during our detailed observation of the behaviour of motion. For understanding in a lucid manner, we have considered Time series plots, Phase plots, Poincare maps and surfaces of section, Fourier spectrums for most of the cases. Attempt also has been made to find through stability analysis the nature of equilibrium solutions of these satellites by varying various parameters. In the present work, we have shown how β, α and γ play an important role in changing the satellite motion from regular to irregular, chaotic and vice-versa. Efforts have been made for studying the bifurcation of fixed points for these satellites when tidal, magnetic and Solar radiation forces are together in action.

Here, we have shown clearly how regular motion may change into irregular and chaotic.

The reasonable approximate values for the critical value of the β, tidal parameter and that of the α, magnetic parameter (Sharma, 2001) have been used in our work.

I have summarized briefly the stability of motion of an artificial Earth satellite. Section I deals with the equation of motion of an artificial Earth satellite when oblateness and drag force are together in action. In section II, we have shown Time series and Phase plots for an artificial Earth satellite when drag force and oblateness are considered together and when we do not consider their influence for clear understanding the effect of atmospheric drag force, oblateness on the equation of motion.

Eventually, we find that tidal force acts as a stabilizing factor and magnetic and solar radiation forces act as perturbing forces in the motion of satellites. Here comes the conclusion that our universe is full of irregular and chaotic motion and therefore the

universe is not the paradigm of order and regularity as is the general belief.