

Modelling resonant planetary systems

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Abstract

Many discovered multi-planet systems are in mean-motion resonances. The aim of this work is to study dynamical processes leading to the formation of resonant configurations on the basis of a unified model described earlier [1]. The model includes gravitational interactions of planets and migration of planets due to the presence of a gas disc. For the observed systems 24 Sex, HD 37124, HD 73526, HD 82943, HD 128311, HD 160691, Kepler 9, NN Ser with planets moving in the 2:1 resonance, it is shown that the capture in this resonance occurs at very wide ranges of parameters of both type I and type II migration. Conditions of migration leading to the formation of the resonant systems HD 45364 и HD 200964 (3:2 and 4:3, respectively) are obtained. Formation scenarios are studied for the systems HD 102272, HD 108874, HD 181433, HD 202206 with planets in high order resonances. We discuss also how gravitational interactions of planets and planetesimal discs lead to the breakup of resonant configurations and the formation of systems similar to the 47 UMa system.

References

[1] Emel'yanenko, V.V.: A study on dynamic processes at late stages in the formation of planetary systems in gas and dust disks, Solar System Research, Vol. 45, pp. 412-419, 2011.