Impact of resonance trapping of planetesimals during planetary migration on metallicities of close-in gas giants

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The physical properties of gas giant exoplanets have gradually become clear thanks to a rapid advance in exoplanet observations in recent years. According to some studies combining the internal structural modelling of gas giant planets with transit observations, the gas giant planets generally contain much more heavy elements (elements heavier than hydrogen and helium) than their central star. Such heavy element excess of gas giant planets is thought to have been brought about by the capture of planetesimals during the formation phases, but this hypothesis still has problems.

According to studies estimating the amount of planetesimals captured by a growing protoplanet, the amount of heavy elements captured in this process is at most ten Earth masses. The estimated amount is not large enough to explain the heavy element excess of the gas giant planets shown in the above studies. In order to solve this problem, this study investigates the capture of planetesimals during the planet migration process, which is different from the growth process investigated before. In particular, we focus on the capture of planetesimals by the mean motion resonances of a migrating gas giant planet (resonance trapping). Performing orbital calculations of planetesimals, we quantitatively discuss the effect of the resonance trapping on the capture of planetesimals by a migrating gas giant planet.

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