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Formation probability of habitable planets in extrasolar planetary systems

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Although the extrasolar planets so far discovered may be limited to gas giant planets, terrestrial planets should also exist commonly in extrasolar planetary systems. First, we review current theoretical models of extrasolar gas giant planet formation and the interpretation on the dynamical properties of known extrasolar planets. Based on the most up-to-date theory of core formation, gas accretion, planet-disk interaction, and the observed distribution of disk mass, we simulate mass-period distributions for systems with gas giant planets around host stars with a range of mass and metallicity. The theoretical predictions are consistent with the observed data of extrasolar gas giant planets. Through the comparison with the observation, we can calibrate poorly constrained parameters in our theoretical model. Next, with the calibrated model, we discuss the distribution of terrestrial planets in habitable zones in extrasolar planetary systems that are beyond detection limits from ground-based observations. Our results suggest that the extrasolar habitable planets may exist around more than 10% of stars in our galaxy. Our prediction will be tested by near future space telescope missions.