Second-generation microlensing planet surveys: a realistic simulation

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Microlensing surveys, which have discovered about a dozen extrasolar planets to date, have focused on the small minority of high-magnification lensing events, which have a high sensitivity to planet detection. In contrast, second-generation experiments, of the type that has recently begun, monitor continuously also the majority of low-magnification events. We carry out a realistic numerical simulation of such experiments. We simulate scaled, solar-like, eight-planet systems, studying a variety of physical parameters (planet frequency, scaling of the snowline with stellar mass R_snow ~ M^s), and folding in the various observational parameters (cadence, experiment duration), with sampling sequences and photometric error distributions taken from the real ongoing experiment. We quantify the dependence of detected planet yield on cadence and experiment duration, e.g., the yield is doubled when going from 3-hour to 15-minute baseline cadences, or from an 80-day-long to a 150-day-long experiment. There is a degeneracy between the snowline scaling index s and the abundance of planetary systems that can be inferred from the experiment, in the context of our scaled solar-analog model. After 4 years, the ongoing second-generation experiment will discover of the order of 50 planets, and thus will be able to determine the frequency of snowline planet occurrence to a precision of 10-30%, assuming the fraction of stars hosting such planets is between 1/3 and 1/10, and a snowline index in the range s=0.5 to 2. If most planetary systems are solar analogs, over 65% of the detected planets will be "Jupiters", five in six of the detected anomalies will be due to a single planet, and one in six will reveal two planets in a single lensing event.

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