Numerical Technique
To follow the evolution of the planetary systems, we use the SWIFT integration software package. This allows us to model a planetary system and a swarm of massless test particles in orbit around a central star. We use the Regularized New Horizons Symplectic algorithm (Laskar & Cirtain, 1994) which integrates close encounters between planets and test particles symplectically. The time step is chosen to be 1/20 of the shortest orbital period in the simulation to ensure accuracy.

Each system’s suitability for harboring additional planets was investigated by randomly distributing 1000 massless test particles in the systems HZ and integrating for 10 or 100 years. The initial test particle eccentricities were the range 0.0 to 0.1 with maximum inclinations of 10 degrees. Most systems were modeled three times to ensure that the results were independent of exact numerical conditions. Stability zones are defined as those regions where a significant number of test particle clusters and remain at constant orbital distance for the duration of the simulation. If stability zones were found, an Earth mass planet was added to the stable zone (with a range of semimajor axis and eccentricity values) and evolved for 10 years.

Determination of Habitable Zones
The location of the habitable zone depends on the mass of the parent star, M, and the composition of the atmosphere of the planet (Kasting, 1993). In this study the mass of the parent star: M_HZ = 0.7 M_0 and M_HZ = 1.5 M_0. This gives a resulting HZ comparable to those defined by Menou & Tabachnik.

Introduction
To date the extrasolar planets have been detected around 107 stars, with 13 of them being multiple planet systems (Schneider, 2004). Observation evidence for the habitability of extrasolar planets is still very fragmentary. A model has been presented by Marcy et al. (2000), suggesting that it is common for rocky worlds to form around young stars. This evidence coupled with the observation by Marcy & Butler (2000) that the mass distribution of exoplanets rises with decreasing mass, leads to the conclusion that up to 50% of all stars may have rocky planets.

For a terrestrial planet to be capable of supporting life we know certain criteria must be met. The presence of a terrestrial planet must have a rocky core with a mass of at least 10% of the mass of the habitable planet (Schneider, 2004). Others require solid liquid water and a range of temperatures that allow the retention of an atmosphere (Kasting et al., 1993). The region including the present conditions of each extrasolar planet is referred to as the habitable zone (HZ). For a terrestrial planet to remain habitable, there must be an additional dynamical component that other planets in the system don't gravitationally perturb the planet outside of its habitable zone. When these conditions are met a system can be considered to be dynamically habitable.

Results & Discussion
To follow the evolution of the planetary systems, we use the SWIFT integration software package. This allows us to model a planetary system and a swarm of massless test particles in orbit around a central star. We use the Regularized New Horizons Symplectic algorithm (Laskar & Cirtain, 1994) which integrates close encounters between planets and test particles symplectically. The time step is chosen to be 1/20 of the shortest orbital period in the simulation to ensure accuracy.

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Five of the systems were found to eject all 1000 test particles within a few million years (HD41500A, HD415415, HD210659, and HD160693) and one system (HD52162) loses a few particles with each planetary interaction (see Fig. 1). Menou & Tabachnik modeled HD160693 which has since been found to host two jovian planets. We find the HZ of HD160691 to be unstable (as suggested by Bodis et al., 2003), likely because the orbital elements for the outer planet remain unconstrained.

Six systems (HD16770, HD159452B, HD561, HD112132, HD216435, and eps Eridani) were considered to be unhabitable. These systems contained regions of TP stability, but Earth mass planets placed in these stable zones could not exist (see Fig. 7). The eccentricity pumping of HD159452B (a) was found to be 1.5 x 10^-5 per year, which was too slow for a low-mass planet to clear the HZ (see Fig. 8).

Two systems were found to have the potential to host habitable planets (HD19493 and HD19637) depending on the initial position and eccentricity of the terrestrial planet. Only two systems were found to be potentially habitable for a wide variety of planetary orbits (HD104895 and HD292263). Both systems had very high eccentricities of 0.9 (see Fig. 10) and due to the low eccentricities of the inner planets the jovians mass planets were also stable over a range of initial conditions (see Fig. 11 & 12).

Simple investigations such as this can determine potential stability within the habitable zones using particle swarms. Investigating the habitability of Earth mass planets within the stable zones requires much more advanced treatment. We are currently investigating the effects of multiple planets on the stability of these systems in an attempt to understand the effects of the true multibody dynamics.

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