AOGS 2005

Habitable Zones for Earth-like Planets in the Extrasolar Planetary Systems

Jianghui JI[1,3] and Lin LIU[2,3]

[1]*Purple Mountain Observatory, Chinese Academy of Sciences, Nanjing 210008, China*
[2]*Department of Astronomy, Nanjing University, Nanjing 210093, China*
[3]*National Astronomical Observatory, Chinese Academy of Sciences,Beijing 100012, China*

The Habitable zones are usually believed to be appropriate environment for terrestrial planets that can provide the liquid-water, subtle temperature, atmosphere components of CO_2, H_2O and N_2 (Kasting et al. 1993), supporting the development and biological evolution of life on their surfaces. In this work, we numerically investigated the dynamical architecture of 47 Uma with the planetary configuration of the best-fit orbital solutions by Fischer et al (2003), to study the existence of the Earth-like planets in the region for 0.05 AU $\leq a \leq$ 2.0 AU for 47 Uma with numerical simulations. In the study, we found that the "hot Earths" at 0.05 AU $\leq a <$ 0.4 AU can dynamically survive at least for 1 Myr. The Earth-like planets can eventually remain in the system for 10 Myr at the areas involved in mean motion resonance (MMR) (e.g., 3:2 MMR and 9:5 MMR) with the inner companion. Moreover, we showed that the 2:1 and 3:1 resonances could be marginally stable, but the 5:2 MMR is unstable. In a dynamical sense, we point out that the most possible candidate habitable environment is that the Earth-like planets may bear the orbits of 0.8 AU $\leq a <$ 1.0 AU and 1.0 AU $< a <$ 1.30 AU (except 5:2 MMR) for relatively lower eccentricities. We also conducted similar studies in other multi-planet systems and found the potential existence of the Earth-like planets in habitable zones.

References

[1] Fischer, D., et al. *ApJ*, **586**, 1394 (2003)
[2] Kasting, J. F., et al. *Icarus*, **101**, 108 (1993)