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ORBITAL STABILITY OF EARTH-LIKE PLANETS IN STELLAR HABITABLE ZONES

Long-term orbital stability of Earth-like planets in stellar habitable zones is necessary for the evolution of any form of life. We are announcing today the results of our studies of orbital stability of terrestrial planets inside the habitable zones of three selected stellar systems with newly discovered giant planets and draw general conclusions on the existence of Earth-type planets in other recently detected extrasolar planetary systems. The report is being presented by Mr. Matthew Noble and Drs. Zdzislaw Musielak and Manfred Cuntz of the University of Texas at Arlington to the American Astronomical Society meeting in Washington, D.C. This study is of special interest because it can assist in the selection process of system candidates for future Earth-like planet search missions such as the *Terrestrial Planet Finder* (TPF), the *Space Interferometry Mission* (SIM), the *Kepler* mission, and others.

We have studied orbital stability of terrestrial planets inside the habitable zones of the following systems: 51 Peg (located in the constellation Pegasus, 48 light-years from the Earth), 47 UMa (located in the constellation Ursa Major [Big Dipper], 43 light-years from the Earth) and HD 210277 (located in the constellation Aquarius, 72 light-years from the Earth), with recently discovered giant planets. The systems have similar habitable zones, however, their giant planets have different masses and significantly different orbital parameters. The obtained results clearly show that stable orbits of terrestrial planets exist in the entire habitable zone (HZ) of 51 Peg as well as in the inner part of the HZ of 47 UMa, but no stable orbits are found in the outer region of the HZ of 47 UMa and in the entire HZ of HD 210277.

Based on these results, we may draw the following general conclusions regarding the existence of stable orbits of terrestrial planets in the HZs of newly detected extrasolar planetary systems. Stable orbits of terrestrial planets inside stellar HZs exist only if orbits of giant planets are located far away from either the inner or outer edge of these zones. Moreover, because of the process of planetary migration (resulting in the ejection of terrestrial planets from the HZs), the existence of Earth-type planets inside stellar HZs may be restricted to only those systems in which giant planets are located far beyond the outer edge of the HZs. This conclusion is obviously consistent with the planet distribution and the existence of life in our Solar System!

For more information:

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Please visit our website: `http://www.uta.edu/physics/planets.html`

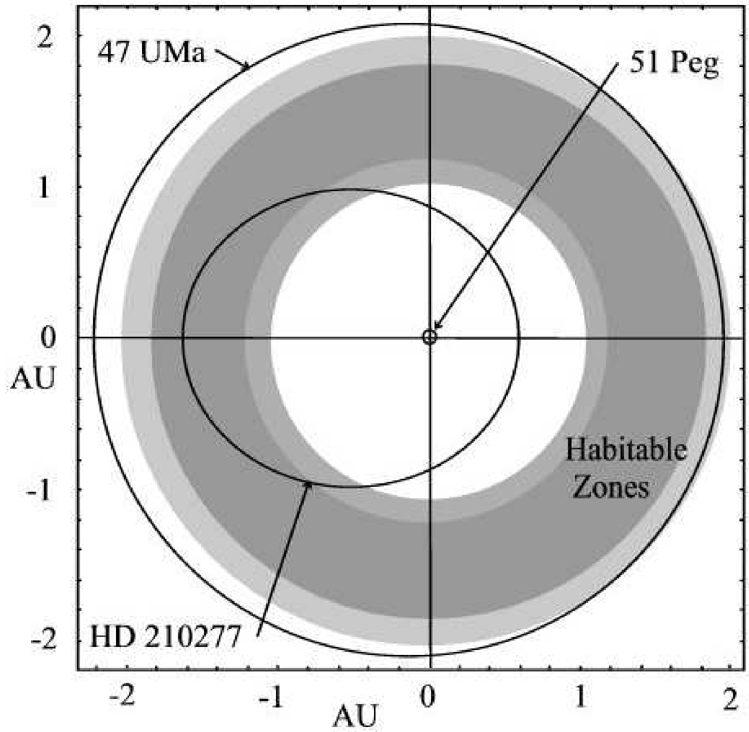

Figure 1: Orbital paths of the extra-solar planets for the three represented systems. For comparison, we also give the HZs for UMa (1.05 to 1.83 AU) and 51 Peg (1.2 to 2.01 AU) (gray areas). The HZ for HD 210277 is similar to that of 51 Peg. This figure was presented to the American Astronomical Society meeting in Washington, DC on January 7, 2002.

EDITORS: This figure can be obtained over the Internet via

`http://www.uta.edu/physics/planets.html` after 9:20 AM EST, January 7, 2002