Climate and Habitability of Earth-like Extrasolar Planets

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Over the past two decades, the study of planets orbiting around other stars has emerged from relative obscurity to the forefront of modern science. After only a brief glance at the cosmos, extrasolar planets appear to be extraordinarily common. The holy grail of the field remains to detect Earth-like planets orbiting distant stars and to characterize their atmospheres. Ultimately, we hope to confirm the existence of habitable, and possibly even inhabited extrasolar planets. To date *Kepler* and ground based surveys have identified numerous planets that reside within the so-called "habitable zone" (HZ). By definition, the HZ is the region in space surrounding a star where a terrestrial planet can support liquid water on its surface. The inner edge of the HZ is bounded by the runaway greenhouse, where a planet becomes too hot and surface water is irreversibly boiled away to space. The outer edge of the HZ is bounded by runaway glaciation, where the planet becomes too cold and surface water is irreversibly frozen. However, the HZ is not static, but rather varies as a function of the stellar type, the age of the star, and also planetary properties such as the composition of the atmosphere, the planet's rotation rate, and carbonate-silicate weathering cycling rates. In this talk, I will review the basic concepts of climate and habitability for Earth-like extrasolar planets found in and near the HZ. While presently this work remains largely theoretical, upcoming missions such as the *James Webb Space Telescope* and the next generation of thirty-meter class ground based telescopes expected to come online in the mid-2020s, will be able to begin characterizing these worlds.