

Which Galaxies Are the Most Habitable?

By Susanna Kohler on 31 August 2015 · FEATURES



The galaxies Maffei 1 (top right) and 2 (bottom left). Maffei 1 is the closest giant elliptical galaxy to the Milky Way. A recent study suggests giant ellipticals may be the most likely galaxies to harbor life. [NASA/JPL-Caltech/UCLA]

Habitable zones are a hot topic in exoplanet studies: where, around a given star, could a planet exist that supports life? But if you scale this up, you get a much less common question: which type of galaxy is most likely to host complex life in the universe? A team of researchers from the UK believes it has the answer.

Criteria for Habitability

Led by Pratika Dayal of the University of Durham, the authors of this study set out to estimate the habitability of a large population of galaxies. The first step in this process is to determine what elements contribute to a galaxy's habitability. The authors note three primary factors:

1. Total number of stars
More stars means more planets!
2. Metallicity of the stars
Planets are more likely to form in stellar vicinities with higher metallicities, since planet formation requires elements heavier than iron.
3. Likelihood of Type II supernovae nearby
Planets that are located out of range of supernovae have a higher probability of being habitable, since a major dose of cosmic radiation is likely to cause mass extinctions or delay evolution of complex life. Galaxies' supernova rates can be estimated from their star formation rates (the two are connected via the initial mass function).

Hospitable Cosmic Giants

Interestingly, these three conditions have previously been shown to be linked via something termed the "fundamental metallicity relation," which relates the total stellar masses, metallicities, and star formation rates of galaxies. By using this relation, the authors were able to create predictions for the number of habitable planets in more than 100,000 galaxies in the local universe (cataloged by the Sloan Digital Sky Survey).

Based on these predictions, the authors find that the galaxies likely to host the largest number of habitable planets are those that have a mass greater than twice that of the Milky Way and star formation rates less than a tenth of that of the Milky Way.

These galaxies tend to be giant elliptical galaxies, rather than compact spirals like our own galaxy. The authors calculate that the most hospitable galaxies can host up to 10,000 times as many Earth-like planets and 1,000,000 times as many gas-giants (which might have habitable moons) as the Milky Way!

Citation

Pratika Dayal et al. 2015 *ApJ* **810** L2 doi:10.1088/2041-8205/810/1/L2 (<http://dx.doi.org/10.1088/2041-8205/810/1/L2>)

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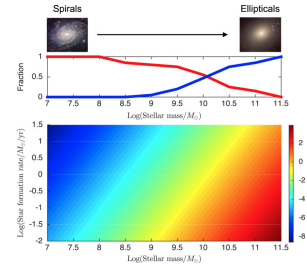
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Lower panel: the number of Earth-like habitable planets (given by the color bar, which shows the log ratio relative to the Milky Way) increases in galaxies with larger stellar mass and lower star formation rates. Upper panel: the larger stellar-mass galaxies tend to be elliptical (blue line) rather than spiral (red line). Click for larger view. [Dayal et al. 2015]