Are We Alone? Observing the TRAPPIST-1 System

Recent observations from NASA’s Spitzer Space Telescope and seven ground-based telescopes have revealed several Earth-sized exoplanets orbiting the nearby TRAPPIST-1 star. Three of the rocky planets are in the habitable zone—where the possibility for life exists.

**TRAPPIST-1 System**
- **8 light-years from Earth**
- **Subdwarf dwarf star with mass 85 times the Sun**
- **7 Earth-sized exoplanets to fit, fit, fit, in**
- **3 potentially habitable zone, 1, 1, 1**

**Habitable Zone**
- The orbits of the planets are within the habitable zone, where the planet could support liquid water on its surface.
- The planets could contain sufficient atmospheric pressure.

**Detection & Analysis**
- The seven Earth-sized planets were discovered by radial velocity variations across the face of the star, which is comparable in size to the Sun. August

**The James Webb Space Telescope (JWST)**
- The JWST, scheduled to launch from French Guiana in October 2018, will use several revolutionary technologies to enable direct imaging of Earth-sized planets around ultracool dwarf stars.

**Why orbit at the L2 point?**
- Orbiting at the second Lagrange point (L2) keeps the telescope in line with the Earth as it moves around the sun, allowing the satellite’s large sunshield to protect the telescope from the intense sunlight. Offering 26 hours of observing time, the JWST will observe primarily in the infrared and will have four instruments to observe 100 objects simultaneously.

**What’s next?**
- The next generation of telescopes—the James Webb Space Telescope, the Giant Magellan Telescope, the Thirty-Meter Telescope and the European Extremely Large Telescope—will soon join the search.

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**Giant Magellan Telescope (GMT)**
- The GMT will have resolving power 15 times greater than the Hubble Space Telescope and will host the largest optical/infrared detector ever made.

**Thirty Meter Telescope (TMT)**
- The TMT will have 10 times the collecting area and more than a factor of 10 better spatial resolution relative to the Hubble Space Telescope.

**European Extremely Large Telescope (E-ELT)**
- The E-ELT will be the largest telescope in the world, six times the size of the current largest, the Very Large Telescope in Chile, and the first to perform detailed exoplanet detection and astrosynthetic research.

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**JWST stats**
- **LAUNCH DATE:** October 2018
- **MISSING DATE:** 1 light-year from Earth
- **SECOND SUN:** 8.0, 10.2
- **TEMPERATURE:** 300 K
- **MIRADUTH:** Near mid-infrared
- **TELESCOPE STYLE:** Ritchey–Chrétien
- **FOCAL LENGTH:** 2,516 m
- **COLLECTING AREA:** 39 m
- **RESOLUTION:** >3
- **WEBSITE:** https://jwst.nasa.gov

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**Why observe in the L2 area?**
- At L2, the telescope is on the second Lagrange point, where the gravitational forces of the Earth and Sun balance to create a stable orbit. The JWST is able to maintain an orbit around L2, allowing it to observe all night and move closer to detecting possible conditions for life.

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**Extremely Large Telescopes**
- The next generation of ground-based infrared telescopes will have resolving power far beyond what is available today, and will probe in the ultracool red dwarf zone to reveal potentially habitable planets.

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