ELPESIT

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The project ELPESIT, acronymus for Earth Like Planet Explorer Space Interferometer Telescope, is a fundamental plan that aims to study Earths like planets orbiting other stars, at a level of detail never reached before by technology. The project consists of a pair of reflective space telescopes of aperture of 15 meters, put each in one of the two stable Lagrange points (L4 and L5) of the Earth – Moon system, in order to obtain a giant telescope system that have an enormous aperture, equivalent to the distances between L points (about 480000 km). This will lead us to achieve an angular resolution (1,27 *10^-15 radiants) that will allow to study atmospheric details of the far exoplanets, hundreds light years away, imagining them and by spectroscopic analysis.
Coronographs can be used with the telescopes to block the star light and study the surrounding of star itself. A third element, the MD (Mirror Delayer) is a complex mirror system that can move along the Moon orbit, that receives light beams from the 2 telescopes and send them to the cameras and the high resolution spectrograph on board.

There are many good planet candidates for this project, but in order to dimostrate the importance of ELPESIT we chose to focus our reserch on the J65 star system and in particular on the two Earth like objects J65-c and J65-d.
J65 is a G5 star in the main sequence, 200 light years away, arboring six planets, two of which are inside the habitable zone. This fact makes them perfect candidates for harboring life. The planet c was first discovered by transit, thanks to James Webb Telescope, then confirmed by radial velocity measured on Earth from several telescopes around the world. Further studies with these techniques highlighted the existence of three other planets, marked a, b, inner and closer to the star and d, a bit more distant than the c planet. Imaging has shown the presence of another two jupiter size bodies, known as e and f, in the outer system, at distances where the previous techniques can't see them with existing technologies.
In particular J65-c and J65-d have already shown the presence of water in both atmosphere and maybe they also have a high level of oxygen, not yet established. If so, they probably harbor life.

While J65-c is 10% smaller than Earth, J65-d is double size of the Earth with probably a thiker atmosphere with much more water in it. We know they are rocky planets, because we know their size and mass, so we can infer the density. Studing the chemical composition of J65 star we can tell they probably have a iron core and a lighter mantle, just like Earth. They are both just inside the edge of the habitable zone and that means there is the strong possibility for liquid water on the surface.
We have seen carbon dioxide (CO_2) in the outer layer of the atmosphere of J65-c and a strong line of methane (CH_4) in J65-d. This allow us to think that at least J65-d could be at a first stage of the life evolution, when life thrived on the sea on Earth. We don't know if oxygen is present, but ELPESIT is sensitive enough to see even a small presence of it, less than 1%.
We could expect that J65-c is more similar to Mars than the Earth, but maybe, if we are lucky, it's like the old Mars, when liquid water was circulating on the surface.

Because the 2 telescopes are in Lagrange points, they orbit the Earth in the same time of the Moon. So, considering a fixed direction on the sky, there are two moments every month in the orbit in which telescopes will have the higher angular amplitude for that direction of sight (and the opposite). In all the other directions the angular resolution will be lower. For a normal direction to the orbital plane the angular resolution would be always the same. J65 is located 60° respect to the Earth – Moon orbital plane. So, two times per month, the angular resolution will be halved respect to the best conditions.
Because the two telescopes orbit, they will be almost always at different distances from J65. The

wave front of light that one telescope will receive from the star will be ahead or late respect to the one of the other telescope. In order to make interferometry, that gives the high angular resolution, this time gap must be compensated. The MD consists of a system of mobile mirrors and prisms, that allows the extremely precise superposition of wave fronts. In order to delay the wave front coming from a telescope respect to the other one, the MD will move along Moon orbit at a distance from telescopes that compensate the gap between the two wave fronts. On board of the MD is mounted several instruments.
A Wide Field Camera, to study the surrounding of the star, that will be used togheter with the coronograph, to block the star light.
A Visible and Near Infrared Ultra Narrow Field Camera, to map planet atmospheres. At a distance of 200 light years, thanks to the big equivalent aperture, we hope to see details as big as 2.5 km in the best conditions of sight and 5 km in the worst.
A Ultraviolet Ultra Narrow Field Camera.
And a Far Infrared Ultra Narrow Field Camera to map the temperature of the two planets and possibly winds.
A Very High Resolution Spectrograph, to search for chemical components of the atmospheres and to determine the presence of important molecules like Oxygen O_2, Ozone O_3 and hydrocarburos.

With this project we hope to obtain a chemical map of the planet atmospheres and maybe a topological description of the surfaces.
The importance to put this system in space is due to the high angular resolution we can achieve and the possibility to study the exoplanet atmospheres in all the wavebands, because the Earth atmosphere blocks some.