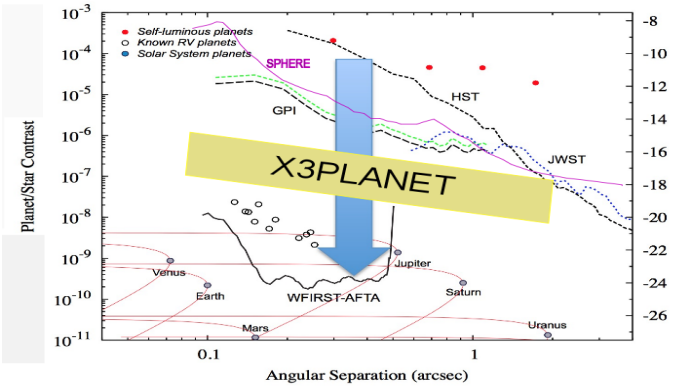
EXTREME HIGH CONTRAST IMAGING OF EXOPLANETS WITH OFF-AXIS TELESCOPES: TECHNOLOGY INCUBATION FOR THE NEXT DECADE. **Maud LANGLOIS**[1] on behalf of the **PLANETS FOUNDATION®**[2], [1] Centre de Recherche Astrophysique de Lyon, Centre National de la Recherche Scientifique (CNRS) and Université de Lyon, 69561, FRANCE, [2] PLANETS FOUNDATION (https://www.planets.life) - Institute for Astronomy, University of Hawaii, 34 Ohia Ku, Pukalani, Maui, HI, USA 96790.

Understanding the nature and distribution of exoplanets in the Universe is one of the fundamental goals of modern astrophysics. However, direct detection and characterization of exoplanets, which are, in many cases often, factors of at least millions fainter than their host star remains extremely challenging because of the blinding light from their star. By making dedicated instruments capable of suppressing this starlight, imaging and characterization of these planets becomes possible. In the recent years few high-contrast instruments (SPHERE, GPI) have been producing the highest levels of contrast, ever demonstrated from the ground, allowing dedicated studies of the largest planets around relatively young stars. Still, these systems will only be able to detect the very youngest, self-luminous giant planets on relatively large orbits. — akin to Jupiter in the first 100 million years of its existence.

If we can expand the ground-based instruments capability to the regime where they would become sensitive to these fainter and closer extra-solar planets, this would already lead to great advances in our understanding of planet formation but it would pave the way to the detection of exolife biomarkers.

We propose here to present several new exploratory techniques (in the fields of extreme adaptive optics, and scattered light suppression) dedicated to enhance the achievable contrast. The ultimate goal of our project is to prepare a cutting edge north hemisphere facility that will provide the community with increased sensitivity to a larger number of exoplanets. The very low scattered light off axis telescope PLANETS offers a unique platform for revealing potential challenges for telescopes and testing approaches to resolve them. Through our collaborations, we are developping a unique US facility (X3PLANET) to gain qualitatively new expertise aimed toward the future giant telescopes.



The above figure shows the capability of the 2.4 m WFIRST-AFTA space facility ; based on figure from the WFIRST-AFTA SDT Interim Report, by D. Spergel et N. Gehrels. On the figure was added the typical SPHERE on-sky performances (in pink) together with (yellow box) the contrast/parameter range of the proposed X3PLANET facility

The PLANETS FOUNDATION group has prototyped several new technologies that will enable lightweight mirror controls, and has developed an optical design for a 75m filled-aperture (60x8m) and 100m partially filled-aperture telescopes which have sufficient aperture and scattered light suppression to allow detection of exoplanet biomarkers and perhaps even civilization technomarkers within 60 light years of the Sun.