

## **SAFIR, the Single Aperture Far-Infrared Observatory, the next big step beyond SIRTf and Herschel.**

SAFIR is a 10-meter, 4 K space telescope optimized for wavelengths between 20 microns and 1 mm. The combination of aperture diameter and telescope temperature will provide a raw sensitivity improvement of more than a factor of 1000 over presently-planned missions. The sensitivity will be comparable to that of the JWST and ALMA, but at the critical far-IR wavelengths where much of the universe's radiative energy has emerged since the origin of stars and galaxies. To introduce SAFIR to the astronomical community, we present the science case for SAFIR with some strawman mission concepts, and we examine the prospects of the key enabling technologies.

As a follow-on to Herschel and SIRTf, SAFIR will be capable of broad-band spectroscopy of any source discovered in the deepest confusion-limited surveys of previous far-IR missions. SAFIR will therefore provide redshifts and ISM conditions of the sources comprising the far-IR background. Looking beyond, the dramatic sensitivity increase will allow the community to address important questions such as: When and how did the first stars form, and what was their impact on the surrounding ISM? How did dark matter haloes coalesce into the progenitors of present-day galaxies? How do black holes interact with their host galaxies? How are planets formed in disks around young stars, and what types of biological building blocks are created during this process?

In spite of the tremendous scientific potential, the technology development for SAFIR is tractable because the mission will leverage heavily on prior missions including JWST, TPF, and Herschel. Key technologies for SAFIR include: bolometric detectors suitable for background-limited spectroscopy from space, cryogenic segmented or membrane mirrors, and cryocoolers capable of cooling a large telescope to below 5 K. All of these technologies are developing rapidly, and show great promise for being mature well before SAFIR's launch date around 2015-2020.