ALMA-SOFIA synergies

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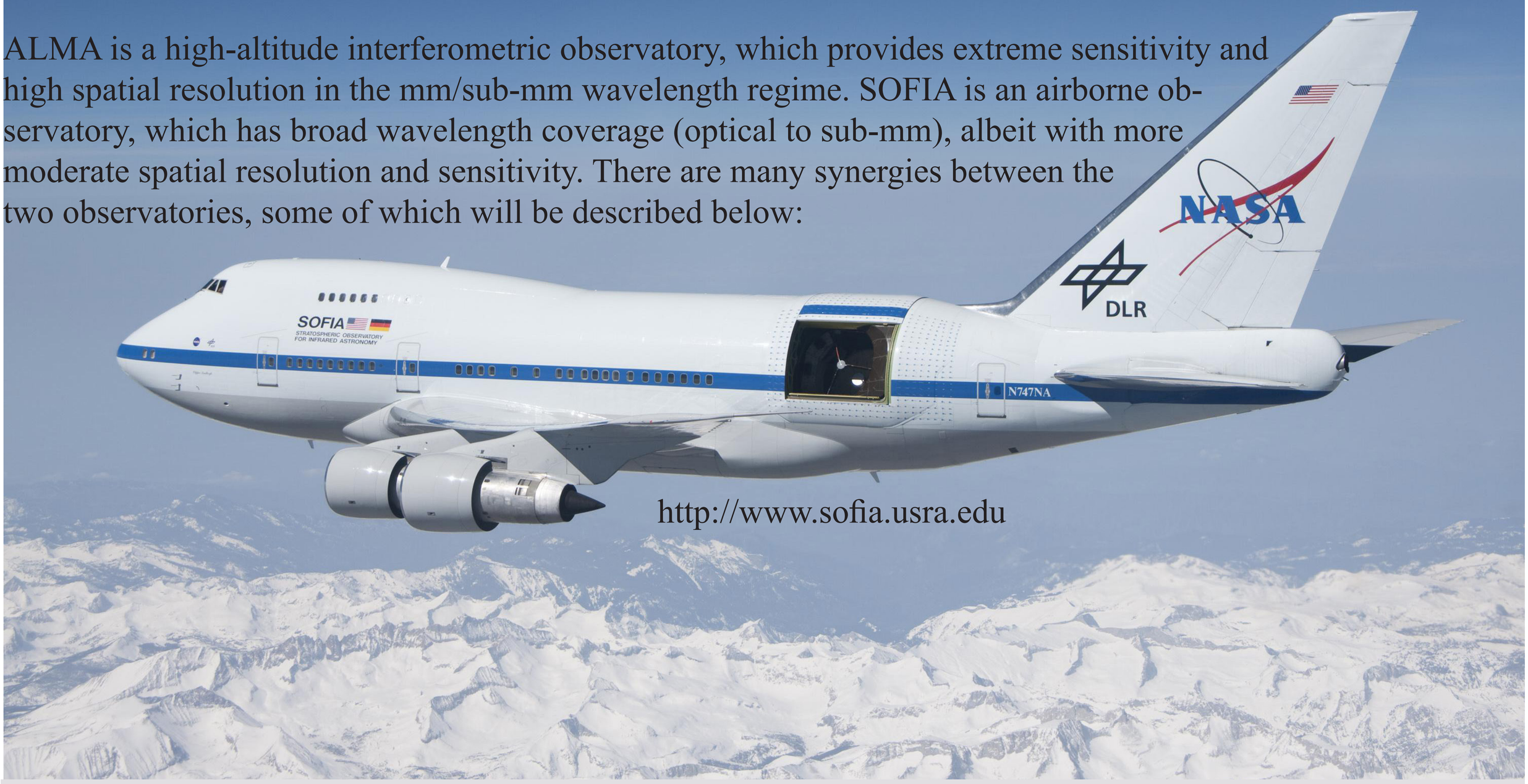
ALMA is a high-altitude interferometric observatory, which provides extreme sensitivity and high spatial resolution in the mm/sub-mm wavelength regime. SOFIA is an airborne observatory, which has broad wavelength coverage (optical to sub-mm), albeit with more moderate spatial resolution and sensitivity. There are many synergies between the two observatories, some of which will be described below:



http://www.sofia.usra.edu

ALMA

Continuum

- observations of both Galactic and Extragalactic objects with extreme sensitivity and spatial resolution in several bands from 3 mm to 350 μm. This is the wavelength regime where continuum emission from dust dominates. The dust emission is optically thin and one can therefore determine the mass of the dust.

Spectroscopy

- spectroscopy from 3 mm to 350 μm with both high spatial and spectral resolution (spectral cubes) of many molecules (rotational transitions) as well as hydrogen recombination lines, enabling studies of interstellar chemistry on many spatial scales (AU - pc).

Polarimetry

- can measure orientation of the magnetic field on small scales, e.g. protostellar disks. Polarimetric imaging as function of wavelength may allow determination of dust alignment and local dust properties.

Summary

- unprecedented sensitivity and angular resolution at millimeter and sub-millimeter wavelengths enabling studies of the cold universe ranging from studies of our solar system to high redshift galaxies. ALMA can benefit from SOFIA's 20 years lifetime!

SOFIA

Continuum

- large scale mapping and photometry from near to far IR, but with limited angular resolution (3" - 20"). SOFIA will discover interesting objects, which can be studied in detail with ALMA. SOFIA will provide crucial information about the luminosity and temperature of these sources, which ALMA cannot do.

Spectroscopy

- spectroscopy with high spectral resolution in the FIR (200 μm - 60 μm) and mid-IR (5 - 30 μm), i.e. wavelength regions that ALMA cannot observe. FIR wavelength regime favors light molecules (hydrides), while the mid-IR gives access to ro-vibrational lines.

Polarimetry

- can measure the orientation on larger scales (protostellar envelopes, prestellar cores, whole molecular clouds). Comparison with ALMA enables us to understand the role of magnetic fields in star formation.

Summary

- extends the wavelength coverage from sub-millimeter to the far- and mid-infrared opening up wavelength windows inaccessible from ground. Due to the limited mirror size (2.5 m) SOFIA will mostly study the local universe, our Galaxy, and nearby galaxies.