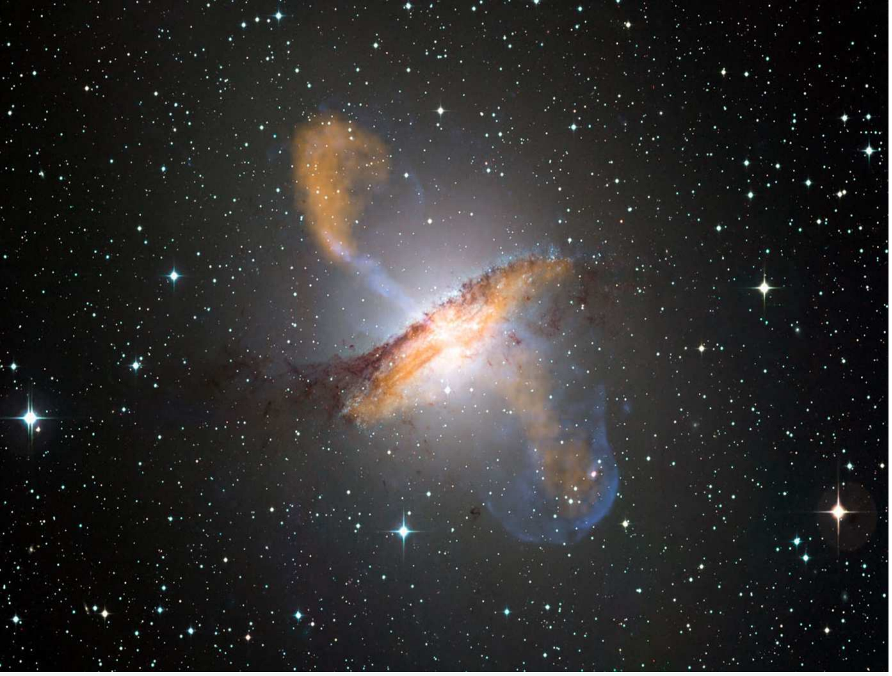

National Aeronautics and Space Administration

Sensors

Far-Infrared Microwave Kinetic Inductance Detector (FIR MKID) Array

Improves the detection of low-power far-infrared (FIR) signals

NASA Goddard Space Flight Center has developed an absorber-coupled far-infrared microwave kinetic inductance detector (FIR MKID) array that incorporates a cross-absorber pattern. It allows incident power to be absorbed equally for both horizontal and vertical polarization. The array enables the output of the detector to be frequency multiplexed at more than twice the frequency of the conventional MKID design. In addition, the technology allows power to be more evenly distributed across the detector area, increasing detector sensitivity. And the detector can be read out at higher operating frequencies than prior art designs, thus increasing the detector array channel capacity.

BENEFITS

- Infrared signal can be coupled to the metal equally for both horizontal and vertical polarization
- Increased resonance frequency of the resonator, thus increasing channel capacity when used in a large array configuration
- Reduced uncertainty in resonance frequency calculation and frequency allocation of each detector

technology solution

THE TECHNOLOGY

The FIR MKID consists of the two major components: (1) the metal pattern for FIR absorption, and (2) the microwave transmission line resonator for RF readout. The cross bar metal pattern on the membrane provides identical power absorption for both horizontal and vertical polarization signals. The metal patterns are placed on both the top and bottom of the membrane to create a parallel-plate-coupled transmission line that acts as a half-wavelength resonator at readout frequencies. The parallel-plate transmission line in the membrane area is connected to a low impedance micro-strip line at the detector edges to form a stepped impedance. The parallel-plate transmission line on the membrane is split into four sections in a meandering cross pattern.

At IR frequencies, the detectors superconducting metal pattern acts as an absorber. It is designed to have the effective area match with the characteristic impedance of free space, resulting in minimum return loss at the center of the operating frequency. This maximizes the power absorption in the metal pattern, causing the temperature of the metal to increase. This enables detection of very low power far infra-red frequency signals that has both horizontal and vertical polarizations.

APPLICATIONS

The technology has several potential applications:

- Space applications involving detection of small far-infra-red signals
- Ground-based astronomy

PUBLICATIONS

Patent No: 9,383,254

More Information

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