The combination of PICO's diverse science goals are achievable using a single instrument that executes one, continuous, simple observing pattern of the entire sky. This pattern integrates noise down to unprecedented levels, and provides for multiple checks of possible systematic errors in the data analysis.

• **Depth** We quantify survey depth in terms of the RMS fluctuations that would give a signal-to-noise ratio of 1 on a sky pixel that is 1 arcminute on a side. Depth in any frequency band is determined by detector sensitivity, the number of detectors in the focal plane, the sky area covered, and the duration of the mission. The science objective driving the depth requirement is SO1, the search for the IGW signal which requires a depth of 0.87 μK $\cdot$ arcmin. This requirement is a combination of the low-level of the signal, the need to separate the various signals detected in each band, and the need to detect and subtract systematic effects to the required levels. • **Sky Coverage** There are several science goals driving a full sky survey for PICO. The term 'full sky' refers to the entire area of sky available after separating other astrophysical sources of confusion. In practice this implies an area of 50-70% of the full sky for probing non-Galactic signals, and the rest of the sky for achieving the Galactic science goals.

(1) Probing the optical depth to the epoch of reionization (STM SO5) requires full sky coverage as the signal peaks in the EE power spectrum on angular scales of 20 to 90 degrees. Measuring this optical depth to limits imposed by the statics of the small number of available ℓ modes is crucial for minimizing the error on the neutrino mass measurement.

(2) If $r \neq 0$, the BB power spectrum due to IGW (STM SO1) also has a local maximum in the same range of angular scales (20 to 90 degrees). For $r \gtrsim 0.001$ (CHECK) this local maximum is at a higher level than the BB lensing spectrum, making this range of scales appealing to survey, as there is no need to separate the signatures of two cosmological signals.

(3) The PICO constraint on N_{eff} (STM SO4) requires a determination of the EE power spectrum to limits imposed by the statics of available ℓ modes. Full sky coverage is required to achieve this limit. (4) PICO's survey of the Galactic plane and regions outside of it is essential to achieving its Galactic structure and star formation science goals (SO6, 7, 8).

• **Frequency Bands** The multitude of astrophysical signals that PICO will characterize determine the frequency range and number of sub-bands that PICO uses. The IGW signal peaks in the frequency range between 30 and 300 GHz. However, Galactic signals, which are themselves signals PICO strives to characterize, are a source of confusion for the IGW. The Galactic signals and the IGW are separable using their spectral signature. Simulations indicate that 21 bands, each with $\sim$25% bandwidth, that are spread across the range of 20 - 800 GHz can achieve the separation at the level of fidelity required by PICO.

Characterizing the Galactic signals, specifically the make up of Galactic dust (SO7), requires spectral characterization of galactic dust in frequencies between 100 and 800 GHz. Aren't there synchrotron questions that are answerable with spectral information?

• **Resolution** Several science objectives require an aperture of 1.5 m and the resolution listed in Table **??**. To reach $\sigma(r)$ =?? we will need to 'delens' the E- and B-mode maps that PICO will generate; see Section **??**. Delensing is enabled with a map that has a native resolution of 2-3 arcminutes at frequencies between 100 and 300 GHz. Similar resolution is required to achieve the constraints on the number of light relics (SO??), which will be extracted from the EE power spectrum at multipoles $100\ell2500$. The process of delensing may be affected by other signals, primarily the signal due to Galactic dust. It is thus required to map Galactic dust to at least the same resolution as at 300 GHz. Higher resolution is mandated by science objectives 6,7, and 8, which require resolution of 1 arcminute at 800 GHz. We have thus chosen to implement diffracted limited resolution between 20 and 800 GHz.