Progress on SuperSpec: A Broadband, On-Chip Millimeter-Wave Spectrometer

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Early Results
Current Lens-Coupled Devices

Stycast AR-coated alumina lens (Dalhousie University)
Normalized Spectral Profiles

BB channels – sections of meandered TiN in proximity to feedline, approx $\lambda$ in length

$Q_{\text{loss}} = 1280$

$\quad \Rightarrow 15\% \text{ loss for } R=100$

$Q_r = 330$

$Q_c = 1600$

$\eta_{\text{peak}} = 0.22$

$Q_i = Q_{\text{loss}} = 1281$
Photon Noise Limited NEP

NEP$_{\gamma}$ for $R=100$
on the ground

$R = 330$ channel with $T_{\text{ext}} = 673$ K

$273$ K

$62$ K

$R > 2000$ channel with $T_{\text{ext}} = 62$ K

NEP at the detector [$W \text{ Hz}^{-1/2}$]

frequency [Hz]
Noise vs Loading

Currently get 10% efficiency

Expect x2 gain from adjusting spectrometer coupling --> 20%

$R = 9.7 \times 10^8 \text{ W}^{-1}$

$\eta_{\text{sys}} = 0.10$

293K loading + coherent source power

$S_{xx} [10^{-15} \text{ Hz}^{-1}]$

$T_{\text{external}} [\text{K}]$
The End

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