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High Resolution Photonic MKID Spectrograph

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High resolution spectrographs employed in astronomy and elsewhere use a primary dispersive component to separate light at angles corresponding to different wavelengths, roughly $d\sin(\theta) = m\lambda$. A secondary dispersive component is then used to separate the orders, $m = 0, 1, 2, 3...$ By this method, spectral features can be very well separated and detected at high spectral resolution ($\frac{\lambda}{\Delta\lambda} > 5000$) on a planar photo-detector (e.g. a CCD) at the expense instrument volume. In this contribution, we consider the advantages and disadvantages of using a photonic circuit at millikelvin temperatures to achieve the primary dispersive function, and an MKID array to achieve the secondary dispersive and photo-detection functions. At the face of it, this approach could miniaturize spectrograph technology at the expense of low temperature complexity. The native energy and timing resolution of the MKIDs is used to discriminate the orders and provide photon arrival information useful in time-resolved spectroscopy. We describe considerations and formulae involved in the design such a spectrograph.

Less than 5 years of experience since completion of Ph.D

Y

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N

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