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THE ANGULAR POWER SPECTRUM OF DUST-OBSCURED GALAXIES AND ITS IMPACT ON SUNYAEV ZEL'DOVICH STUDIES

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RESUMEN

En este trabajo medimos el espectro angular de potencias de la población de galaxias milimétricas (SMGs) a partir de observaciones a 1.1 mm realizadas con la cámara AzTEC en el Atacama Submillimeter Telescope Experiment (ASTE) y el James Clerk Maxwell Telecope (JCMT). La muestra de campos observados nos permite comparar el espectro angular de potencias de las SMGs medido en la dirección de regiones del Universo sin sesgo y otras sobre densas. Nuestras mediciones permiten acotar el impacto que tiene la población de SMGs en mediciones del espectro de potencias de las fluctuaciones primarias y secundarias del fondo cósmico de radiación de microndas (CMB), que actualmente están siendo medidas por una nueva generación de experimentos con resoluciones espaciales del orden de minutos de arco y que operan a longitudes de onda milimétricas.

ABSTRACT

In this work we measure the angular power spectrum (APS) of the population of (sub-)millimetric galaxies (SMGs) using 1.1 mm wavelength observations obtained with the AzTEC camera on the Atacama Submillimeter Telescope Experiment (ASTE) and the James Clerk Maxwell Telescope (JCMT). The sample of survey fields allows us to compare the properties of the APS of the (sub-)mm galaxy population towards unbiased and potentially overdense regions of the Universe. Furthermore, our measurements provide a strong constraint to the impact that the SMGs have on the APS of the primary and secondary CMB anisotropies, which are being measured by the new generation of arcminute resolution SZE experiments at millimeter wavelengths.

Key Words: cosmic background radiation — cosmology: observations — submillimeter: galaxies

1. INTRODUCTION

A new generation of arcmin resolution CMB experiments with (sub-)mm wavelength detectors are currently operating (e.g. ACT, SPT, *Planck*, etc). One of their main goals is to accurately trace the APS of the CMB anisotropies at scales of a few arcminutes ($2000 \lesssim \ell \lesssim 8000$). At these angular scales the power of the primary CMB anisotropies drops exponentially, and the shape and amplitude of the CMB APS starts to be dominated by secondary anisotropies, mainly due to the thermal Sunyaev Zel'dovich effect (SZE, Sunyaev & Zeldovich 1970), a redistribution of the CMB photons energy due to their interactions with the free electrons in the hot intra-cluster-medium (ICM) of massive galaxy clusters. The amplitude of the SZE APS is strongly related to the amplitude of mass fluctuations in the Universe ($\propto \sigma_8^7$, Komatsu & Seljak 2002). To take advantage of this property, however, accurate measurements and a proper understanding of different systematic errors is required.

At $\ell \gtrsim 3000$, however, the APS of the SMG population and radio galaxies with strong millimetric emission, significantly contribute to the total APS, and dominate it at the highest multipoles. Though the brightest radio galaxies and SMGs may be identified and extracted from the arcmin resolution maps, the remaining population of fainter SMGs will still contribute to the measured APS, thereby contaminating and introducing systematic errors to any results or parameters derived from these observations.

In this work we use 1.1 mm observations taken with the 144 bolometer camera AzTEC (Wilson et al. 2008) on the 10 m ASTE ($\theta_{\rm fwhm} \approx 30''$) and the 15 m JCMT ($\theta_{\rm fwhm} \approx 18''$), to measure and compare the APS of SMGs towards unbiased blank fields and potentially over dense regions of the Universe. Our measurements also allow a more direct observational estimation of the contamination to SZE studies due to the SMGs, which is commonly predicted from theoretical and semi-analytical models constrained by shorter wavelength results (e.g. 850 μm SCUBA and 250, 350, 500 μm BLAST galaxy number counts).

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