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STUDYING THE PROPERTIES OF MASSIVE GALAXIES IN PROTOCLUSTERS USING MILLIMETRE-WAVELENGTH OBSERVATIONS

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RESUMEN

Presentamos un análisis de densidad y distribución espacial de la población de fuentes milimétricas (MMGs) hacia 17 galaxias activas a altos corrimientos al rojo usando observaciones a 1.1 mm tomadas con la cámara AzTEC en los telescopios ASTE (Atacama Submillimeter Telescope Experiment) y JCMT (James Clerk Maxwell Telescope). La muestra nos permite estudiar las propiedades de las MMGs en ambientes protocumulares (sesgados) y compararlas con la población de campos blancos (sin sesgo). El objetivo es identificar si estos ambientes sesgados son responsables de las diferencias en el número y distribución de galaxias oscurecidas por polvo, y averiguar si estos cambios apoyan la sugerencia de que las MMGs pueden ser las progenitoras de las galaxias (elípticas) masivas que vemos hoy en día en el centro de los cúmulos más ricos.

ABSTRACT

We present an analysis of the number density and spatial distribution of the population of millimetre galaxies (MMGs) towards 17 high-z active galaxies using 1.1 mm observations taken with the AzTEC camera on the Atacama Submillimeter Telescope Experiment (ASTE) and the James Clerk Maxwell Telescope (JCMT). The sample allows us to study the properties of MMGs in protocluster environments and compare them to the population in blank (unbiased) fields. The goal is to identify if these biased environments are responsible for differences in the number and distribution of dust-obscured star-forming galaxies and whether these changes support the suggestion that MMGs are the progenitors of massive (elliptical) galaxies we see today in the centre of rich clusters.

Key Words: cosmology: observations — galaxies: high-redshift — galaxies: active — submillimeter: galaxies

1. INTRODUCTION

In the nearby universe clusters have been detected and extensively studied across the full multi-wavelength spectrum. Their progenitors, however, have been very difficult to identify with traditional methods such as the detection of X-ray extended emission or the identification of galaxy overdensities. X-ray emission has a positive k-correction and little of it is expected from protoclusters beyond $z \sim 2$. While cluster detection by red sequence algorithms is observationally cheap for large sky areas, clusters are typically detected using this method up to $z = 1$.

An effective technique to identify protoclusters, which has already been used in narrow-emission-line surveys, consists of targeting high-z powerful radio galaxies (Miley & De Breuck 2008). These objects have a massive stellar component and very extended neutral gas reservoirs. In addition, low-z radio galaxies usually lie in moderately rich clusters. These reasons imply that active galaxies could signpost the location of peaks in the underlying matter density-field of the universe and hence, the location of young clusters in the process of formation.

The study of millimetre sources in protocluster regions is of special interest because these heavily obscured star-forming galaxies have rest frame far-infrared fluxes that imply intrinsic luminosities $>10^{12}$ $L_{\odot}$, star formation rates >100 $M_{\odot}$ (Blain et al. 2002), and halo masses $>10^{11}$ $M_{\odot}$ (Capak et al. 2011). These estimations make them good candidates to be progenitors of the massive elliptical galaxies in the centre of rich clusters.

This work presents 1.1 mm observations obtained with AzTEC (Wilson et al. 2008) towards 17 powerful active galaxies in order to study the number density and spatial distribution of MMGs in protocluster fields. We analyze the influence of a biased environment on the formation and evolution of this dust-enshrouded galaxy population, and determine whether these galaxies could evolve into massive ellipticals.

Our sample is part of a larger project, the AzTEC Cluster Environment Survey (ACES), which studies

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