Properties of Submillimeter Galaxies in a Semi-analytic Model using the "Count Matching" Approach: Application to the ECDF-S

Alejandra M. Muñoz Arancibia[1], Felipe P. Navarrete[2,3], Nelson D. Padilla[1,4], Sofía A. Cora[5,6], Eric Gawiser[7], Peter Kurczynski[7] and Andrés N. Ruiz[6,8,9]

[1] *Instituto de Astrofísica, Pontificia Universidad Católica de Chile, Av. Vicuña Mackenna 4860, Santiago, Chile*
[2] *Argelander-Institut für Astronomie, Auf dem Hügel 71, Bonn, D-53121, Germany*
[3] *Max-Planck-Institut für Radioastronomie, Auf dem Hügel 69, Bonn, D-53121, Germany*
[4] *Centro de Astro-Ingeniería, Pontificia Universidad Católica de Chile, Av. Vicuña Mackenna 4860, Santiago, Chile*
[5] *Instituto de Astrofísica de La Plata (CCT La Plata, CONICET, UNLP), Facultad de Ciencias Astronómicas y Geofísicas, Universidad Nacional de La Plata, Paseo del Bosque s/n, B1900FWA, La Plata, Argentina*
[6] *Consejo Nacional de Investigaciones Científicas y Técnicas, Rivadavia 1917, C1033AAJ Buenos Aires, Argentina*
[7] *Department of Physics and Astronomy, Rutgers, The State University of New Jersey, Piscataway, NJ 08854, USA*
[8] *Instituto de Astronomía Teórica y Experimental (IATE, CCT Córdoba, CONICET, UNC), Laprida 854, X5000BGR, Córdoba, Argentina*
[9] *Observatorio Astronómico de Córdoba, Universidad Nacional de Córdoba, Laprida 854, Córdoba, X5000GBR, Argentina*

Abstract

We present a new technique for modeling submillimeter galaxies (SMGs): the "Count Matching" approach. Using lightcones drawn from a semi-analytic model of galaxy formation, we choose physical galaxy properties given by the model as proxies for their submillimeter luminosities, assuming a monotonic relationship. As recent interferometric observations of the Extended Chandra Deep Field South show that the brightest sources detected by single-dish telescopes are comprised by emission from multiple fainter sources, we assign the submillimeter fluxes so that the combined LABOCA plus bright-end ALMA observed number counts for this field are reproduced. After turning the model catalogs given by the proxies into submillimeter maps, we perform a source extraction to include the effects of the observational process on the recovered counts and galaxy properties. We find that for all proxies, there are lines of sight giving counts consistent with those derived from LABOCA observations, even for input sources with randomized positions in the simulated map. Comparing the recovered redshift, stellar mass and host halo mass distributions for model SMGs with observational data, we find that the best among the proposed proxies is that in which the submillimeter luminosity increases monotonically with the product between dust mass and SFR. This proxy naturally reproduces a positive trend between SFR and bolometric IR luminosity. The majority of components of blended sources are spatially unassociated.