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A VARIABLE IMF SLOPE TO FIT THE LCDM PICTURE TO OBSERVED HIGH-Z SUBMILLIMETER SOURCES

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RESUMEN

El uso de una función inicial de masa (FIM) Salpeter permite describir bastante bien una gran variedad de propiedades en galaxias. Sin embargo, algunos estudios han encontrado que es necesario cambiar ésta a una FIM plana en brotes de formación estelar para dar una predicción adecuada en la abundancia de galaxias submilimétricas (SMGs) a altos corrimientos al rojo. Mostramos los resultados preliminares de una implementación de la pendiente de una FIM que depende de la intensidad de formación estelar en un modelo semi-analítico de formación de galaxias, el cual ha sido conectado con un código espectrofotométrico que entrega un tratamiento adecuado de luz estelar reprocesada por polvo. También exploramos efectos sistemáticos en las cuentas de fuentes submm provenientes del tamaño del haz del receptor teniendo en cuenta la correlación espacial de fuentes y objetos en el primer plano. Esto ayuda a aligerar las discrepancias entre modelo y observaciones.

ABSTRACT

Using a Salpeter initial mass function (IMF) allows to describe fairly well a large variety of properties in galaxies. However, some studies have found that it is necessary to change it for a top-heavy IMF in starbursts to give an adequate prediction in the abundance of submillimeter galaxies (SMGs) at high redshifts. We show preliminary results of an implementation of a star formation intensity dependent IMF slope in a semi-analytic model of galaxy formation, which has been connected with a spectrophotometric code that provides an adequate treatment of reprocessed starlight by dust. We also explore systematic effects on the counts of submm sources coming from the beamsize of the receiver taking into account the spatial correlation of sources and foreground objects. This helps alleviate the discrepancies found between the model and the observations.

Key Words: galaxies: evolution — galaxies: high-redshift — methods: numerical — submillimeter: galaxies

1. SUBMILLIMETER GALAXIES

The SMGs (Hughes et al. 1998) are generally interpreted as being dust-enshrouded starbursts, in which the dust is being heated by UV radiation from young stars. In order to address the way these galaxies fit into current theories of galaxy formation, it is necessary to model their stellar populations as well as their dust content.

Baugh et al. (2005, hereafter B05) developed a model which predicts the abundance of SMGs in a ΛCDM cosmology. They adopted a top-heavy IMF for stars formed in bursts, having this the biggest impact on the counts of submm sources, compared with the assumption of a Kennicutt IMF, where the counts were dramatically underpredicted.

2. THE MODEL

We use the semi-analytic model of galaxy formation (SAG) developed by Lagos et al. (2008, hereafter LCP08) within the ΛCDM framework. The cosmological parameter values assumed are $\Omega_m = 0.3$, $\Omega_\Lambda = 0.7$ and $h = 0.7$. SAG considers processes of gas cooling, star formation, feedback from core-collapse supernovae explosions and AGN, galaxy mergers and chemical enrichment of baryons. Evolutionary synthesis models are considered (Bruzual & Charlot 1993) assuming a Salpeter IMF. In addition we also use the GRASIL code (Silva et al. 1998), which computes each integrated spectral energy distribution based on the star formation and metal enrichment histories predicted by SAG. Thus the properties of galaxies are produced consistently, taking into account extinction at short wavelengths and thermal re-emission in the IR.

We follow the history of galaxies inside a periodic box of 67.68 h^{-1} Mpc, and assume that this sample is statistically representative of the overall galaxies

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