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MODELING STELLAR POPULATIONS NEAR AND FAR

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RESUMEN

Presento un resumen de la situación actual de la determinación de la masa de galaxias basada en el uso de modelos de síntesis de poblaciones estelares a edades en las cuales la estrellas de la TP-AGB dominan el cercano IR (≈1 Gyr). Las estimaciones de masa de galaxias con población estelar dominante cercanas a esta edad dependen críticamente en el tratamiento dado a estas estrellas en los modelos de síntesis de poblaciones. Presento algunos resultados preliminares de Charlot, S., & Bruzual, G. (2011, in preparation) y una lista de puntos que requieren pronta revisión para avanzar en el campo de la síntesis de poblaciones estelares.

ABSTRACT

I summarize the current status of the determinations of galaxy masses based on population synthesis models at ages at which the TP-AGB stars dominate the NIR luminosity (≈1 Gyr). Mass estimates of galaxies with dominant stellar populations in this age range thus depend critically on the treatment of TP-AGB stars in population synthesis models. Here I present some preliminary results from Charlot, S., & Bruzual, G. (2011, in preparation) and a list of weak points in the modeling of stellar populations that hopefully will be improved in the near future.

Key Words: galaxies: evolution — Galaxy: stellar content — stars: AGB and post-AGB

1. INTRODUCTION

In the last few years we have seen considerable progress in the quality and extent of data sets used as ingredients in population synthesis models. Stellar evolution models with updated input physics for stars up to 15 $M_\odot$ have been computed by Bertelli et al. (2008). Marigo & Girardi (2007), and Marigo et al. (2008) provide a semi-empirical prescription to follow the evolution of TP-AGB stars that includes several important theoretical improvements over previous calculations. The Marigo & Girardi (2007) prescription has been calibrated using carbon star luminosity functions in the Magellanic Clouds and TP-AGB lifetimes (star counts) in Magellanic Cloud clusters. Bertelli et al. (2008) use different TP-AGB tracks, also based on the Marigo & Girardi (2007) prescription, but extrapolated to different chemical compositions of the stellar envelope.

Numerous stellar spectral libraries are available and ready to use for population synthesis models (cf. Figure 10). On the theoretical side, spectral libraries of theoretical model atmospheres by Lanz & Hubeny (2003); Martins et al. (2005); Rodríguez-Merino et al. (2005); Coelho et al. (2007); Lanz & Hubeny (2007), and Aringer et al. (2009), represent important improvements over the Westera et al. (2002) BaSeL 3.1 atlas, both in spectral resolution and coverage of physical parameters. Similarly, the IndoUS (Valdes et al. 2004), Miles (Sánchez-Blázquez et al. 2006), and HNGSL (Heap et al. 2006) libraries provide high quality empirical spectra with excellent coverage of parameter space in the optical range (the HNGSL covers down to 2000 Å) for stars of different metallicities not far from $Z_\odot$, increasing the number of available spectra by a factor of roughly 20 with respect to the Stelib library (Le Borgne et al. 2003) used in BC03. IR spectra of unprecedented quality are contained in the IRTF library (Rayner et al. 2009). The compilation of IR spectra by Lançon & Mouhcine (2002) is particularly useful for upper-AGB stars.

Using these new ingredients, Charlot & Bruzual (2011, hereafter CB11) have built a series of population synthesis models that overcome many of the problems present in previous generations of models, Bruzual & Charlot (e.g., 2003, hereafter BC03). The CB11 models are built using the Bertelli et al. (2008) evolutionary tracks, the Marigo & Girardi (2007) and Girardi et al. (2010, private communication) TP-AGB prescriptions, and the Miles (Sánchez-Blázquez et al. 2006) stellar library, complemented at the hot effective temperature end by theoretical model atmospheres from Lanz & Hubeny (2003); Martins et al. (2005); Rodríguez-Merino et al. (2005), and Lanz & Hubeny (2007), and at the cool end by the IRTF library (Rayner et al. 2009),

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