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PLANETARY NEBULAE IN THE INNER MILKY WAY II: THE BULGE-DISK TRANSITION

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RESUMEN

En este trabajo se usa una muestra de nebulosas planetarias localizadas en el disco interno y en el bulbo de la Galaxia con objeto de encontrar la distancia galactocéntrica que mejor separa estas dos poblaciones desde el punto de vista de las abundancias. Se utilizan escalas de distancias estadísticas para estudiar la distribución de abundancias en la interfase disco-bulbo. Mediante una prueba de Kolmogorov-Smirnov se encuentra la distancia a la cual las propiedades químicas de estas regiones mejor se separan.

El resultado del análisis estadístico indica que, en promedio, la población interior tiene menores abundancias que la exterior. Además, la población interior no sigue el gradiente radial del disco hacia el centro galáctico. Basados en nuestros resultados, sugerimos que la interfase disco-bulbo está situada a 1.5 kpc del centro, y marca la transición entre la población del bulbo y la del disco interno, definida como la población de masas intermedias.

ABSTRACT

In this work, a sample of planetary nebulae located in the inner-disk and bulge of the Galaxy is used in order to find the galactocentric distance which better separates these two populations, from the point of view of abundances. Statistical distance scales are used to study the distribution of abundances across the disk-bulge interface. A Kolmogorov-Smirnov test is used to find the distance at which the chemical properties of these regions better separate.

The results of the statistical analysis indicate that, on the average, the inner population has lower abundances than the outer. Additionally, for the α-element abundances, the inner population does not follow the disk radial gradient towards the galactic center. Based on our results, we suggest a bulge-disk interface at 1.5 kpc, marking the transition between the bulge and inner-disk of the Galaxy as defined by the intermediate mass population.

Key Words: Galaxy: abundances — Galaxy: evolution — planetary nebulae: general — techniques: spectroscopic

1. INTRODUCTION

Chemical abundances of Planetary Nebulae (PNe) are an important tool to investigate the chemical evolution of the Galaxy. As a final stage of evolution of low and intermediate-mass stars ($\sim$1–8 $M_{\odot}$), the abundances of α-elements found in PNe usually are not modified by the evolution of the progenitor star. In this sense, chemical abundances of PNe can be used to study the chemical evolution of galaxies as done by Maciel, Lago, & Costa (2005, 2006), Fu et al. (2009), Stanghellini & Haywood (2010).

The chemical abundances obtained from PNe are relatively accurate and the nebulae can be observed at large distances in the Galaxy, even in regions obscured by the dust in the galactic disk, since they have bright emission lines, such as [O III]λ500.7 nm and Hα. Therefore PNe are useful to study the pattern of abundances in the inner-disk and bulge of the