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PROPER MOTION STUDY OF THE MAGELLANIC CLOUDS USING SPM MATERIAL

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RESUMEN

Se han determinado los movimientos propios absolutos de estrellas y galaxias hasta $V = 17.5$ en un área de 450 grados cuadrados que engloba a las Nubes de Magallanes. El material observacional empleado incluye placas fotográficas y observaciones CCD del programa de Movimientos Propios del Sur de Yale/San Juan. Mediciones locales de movimientos propios relativos son combinadas en una solución de traslapo, usando estrellas del disco Galáctico seleccionadas fotométricamente para definir un sistema global de referencia relativo, que luego es transformado a absoluto usando galaxias externas y estrellas Hipparcos para colocarlo en el ICRS. El catálogo resultante de 1.4 millones de objetos es utilizado para obtener el movimiento propio medio absoluto de las Nubes Grande y Pequeña de Magallanes; $(\mu_\alpha \cos\delta, \mu_\delta)_{\rm LMC} = (+1.89, +0.39) \pm (0.27, 0.27)$ msa año^{-1} y $(\mu_\alpha \cos\delta, \mu_\delta)_{\rm SMC} = (+0.98, -1.10) \pm (0.30, 0.29)$ msa año^{-1}. Estos resultados están basados en dos muestras seleccionadas con las mejores estrellas, 3822 de la LMC y 964 de la SMC. Una determinación mucho más precisa del movimiento propio relativo de la SMC con respecto a la LMC se pudo obtener; $(\mu_\alpha \cos\delta, \mu_\delta)_{\rm SMC-LMC} = (-0.91, -1.49) \pm (0.16, 0.15)$ msa año^{-1}. Este valor diferencial fue combinado con mediciones del movimiento propio de la LMC existentes en la literatura para obtener nuevas mediciones para la SMC, así como también para obtener un estimado de la diferencia de velocidad entre las dos nubes con un error de ± 54 km s^{-1}.

ABSTRACT

Absolute proper motions are determined for stars and galaxies to $V = 17.5$ over a 450 square-degree area that encloses both Magellanic Clouds. The proper motions are based on photographic and CCD observations of the Yale/San Juan Southern Proper Motion program. Multiple, local relative proper motion measures are combined in an overlap solution using photometrically selected Galactic disk stars to define a global relative system that is then transformed to absolute using external galaxies and Hipparcos stars to tie into the ICRS. The resulting catalog of 1.4 million objects is used to derive the mean absolute proper motions of the Large Magellanic Cloud and the Small Magellanic Cloud; $(\mu_\alpha \cos\delta, \mu_\delta)_{\rm LMC} = (+1.89, +0.39) \pm (0.27, 0.27)$ mas yr^{-1} and $(\mu_\alpha \cos\delta, \mu_\delta)_{\rm SMC} = (+0.98, -1.10) \pm (0.30, 0.29)$ mas yr^{-1}. These mean motions are based on best-measured samples of 3822 LMC stars and 964 SMC stars. A more precise determination can be made for the proper motion of the SMC relative to the LMC; $(\mu_\alpha \cos\delta, \mu_\delta)_{\rm SMC-LMC} = (-0.91, -1.49) \pm (0.16, 0.15)$ mas yr^{-1}. This differential value is combined with measurements of the proper motion of the LMC taken from the literature to produce new absolute proper motion determinations for the SMC, as well as an estimate of the total velocity difference of the two clouds to within 54 km s^{-1}.

Key Words: astrometry — catalogs — Magellanic Clouds — proper motions

1. INTRODUCTION

The most recent HST results on the proper motions of the Magellanic Clouds have suggested (Kallivayalil et al. 2006; Kallivayalil, van der Marel, & Alcock 2006; Piatek, Pryor, & Olszewski 2008), opposite to a long-held paradigm, that they are not bound to the Galaxy. Since it is widely accepted that the external and internal features of these galaxies, have been largely determined by the orbit they have followed in the past few Gigayears, it is critical to determine their space velocity as accurately and precisely as possible. The radial component of

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