Revista Mexicana de Astronomía y Astrofísica, **47**, 345–356 (2011)

SPACE REDDENINGS FOR FIFTEEN GALACTIC CEPHEIDS

D. G. Turner,[1] R. F. MacLellan,[2] A. A. Henden,[3] and L. N. Berdnikov[4]

Received 2011 February 24; accepted 2011 June 27

RESUMEN

Derivamos enrojecimientos espaciales para 15 Cefeidas galácticas a partir de datos CCD $BV(RI)_C$ desenrojecidos para estrellas tipo AF en las vecindades inmediatas de esas variables, en conjunción con enrojecimientos 2MASS de estrellas tipo BAF en los mismos campos. Analizamos las soluciones potenciales de enrojecimiento utilizando el método de extinción variable para identificar estrellas con distancias y enrojecimientos similares a las de las Cefeidas, muchas de las cuales presentan excesos de color. Hemos modificado ligeramente la relación de color intrínseco $BV(RI)_C$ para enanas AF en nuestro análisis, de tal forma que los colores observados para estrellas no enrojecidas en la muestra queden descritos de forma apropiada.

ABSTRACT

Space reddenings are derived for 15 Galactic Cepheids from dereddening CCD $BV(RI)_C$ data for AF-type stars in the immediate vicinities of the variables, in conjunction with 2MASS reddenings for BAF-type stars in the same fields. Potential reddening solutions were analyzed using the variable-extinction method to identify stars sharing potentially similar distances and reddenings to the Cepheids, several of which have large color excesses. The intrinsic $BV(RI)_C$ color relation for AF dwarfs was modified slightly in the analysis in order to describe better the colors observed for unreddened stars in the samples.

Key Words: methods: observational — stars: variable: Cepheids — ISM: dust, extinction

1. INTRODUCTION

Because of the deleterious effects of interstellar reddening and extinction, it is difficult to establish an empirical picture of the Cepheid instability strip based entirely upon observations of Milky Way Cepheids. The use of extragalactic Cepheids is not necessarily a practical solution to the problem, since the available data for Milky Way Cepheids are generally more extensive and of greater precision, and the effects of internal reddening within other galaxies are not as well established as they are locally. Such considerations justify the continued use of the Galactic sample in studies aimed at establishing reliable intrinsic properties of classical Cepheid variables.

The determination of accurate reddenings for Cepheids has traditionally followed three different routes: (i) from field reddenings of specific objects (e.g., binary, cluster, association, or isolated Cepheids) based upon the analysis of photometric data for early-type stars sharing the same lines of sight, (ii) from observations mainly of bright Cepheids involving photometric parameters designed to be independent of interstellar reddening, and (iii) from using standard reddening laws and a calibrated intrinsic color relation (either observational or model generated) to deredden photometric observations for large samples of Cepheids. Methods (i) and (ii) are the most reliable means of establishing reddenings for individual Cepheids since method (iii) may entail use of period-color relations (e.g., Fernie 1990a,b), which do not account for the intrinsic spread in effective temperature of the Cepheid instability strip and may generate erroneous results (see Turner 1995).

For method (ii), spectroscopic indices related to stellar effective temperature and designed to be independent, or relatively independent, of interstellar and atmospheric extinction include the Γ-index (Kraft 1960; Spencer Jones 1989), which measures

[1]Saint Mary's University, Halifax, Nova Scotia, Canada.
[2]Queen's University, Kingston, Ontario, Canada.
[3]AAVSO, Cambridge, Massachusetts, USA.
[4]Sternberg Astronomical Institute, Moscow, Russia.