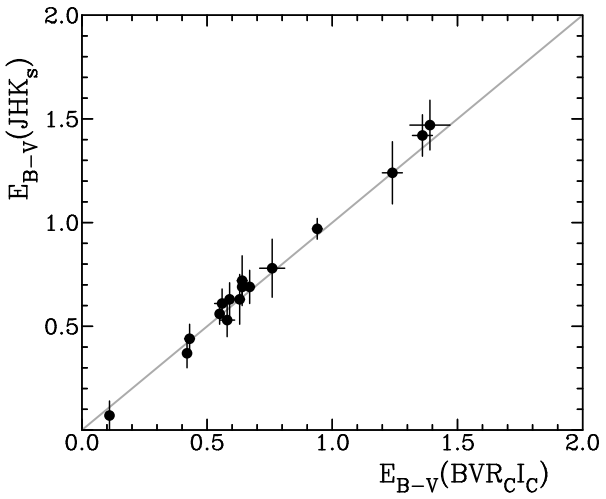

Fig. 8. Comparison of derived 2MASS reddenings, with their uncertainties, for the Cepheids in our sample with the color-corrected broad band $BV(RI)_C$ reddenings. The gray line represents expectations for an exact match.

ference in color cannot be considered definitive. Detailed atmospheric abundance studies of both stars should help to solidify their classifications and establish if there are obvious differences in color between classical and Type II Cepheids.

Figure 8 plots the inferred 2MASS reddenings for our sample Cepheids relative to their broad band $BV(RI)_C$ reddenings, where we have included the second result for the UY Mon field because of the obvious separation in Figures 3 and 5 of stars of small reddening from those of large reddening, for which separate solutions were obtained. The close agreement of both sets of reddenings in Figure 8 indicates that the two techniques are of comparable reliability for establishing field reddenings of Galactic objects, although there is clearly greater precision in the $BV(RI)_C$ color excesses.

5. DISCUSSION

The present study was undertaken as a feasibility test of the use of CCD $BV(RI)_C$ photometry for studying the space reddening of Galactic Cepheids. The $BV(RI)_C$ data by themselves were sometimes insufficient to define the field reddenings of each Cepheid unambiguously, but the addition of 2MASS reddenings and initial "predictions" guided the process successfully. The number of Galactic Cepheids of well-established field reddening has been increased from 40 (Laney & Caldwell 2007) to 55 by this study, and the sample now includes a few Type II Cepheids, some of which appear to display slightly bluer intrinsic $(V–R)_C$ and $(V–I)_C$ colors relative to their classical Cepheid cousins. A comparable test using reddenings derived from 2MASS JHK_s colors indicates that the 2MASS survey may also be suitable for the derivation of space reddenings, for a variety of stellar types and not just Cepheids. Further studies of that possibility have already been initiated (Majaess et al. 2008a,b).

The results of this study have already been used in a preliminary mapping of the Cepheid instability strip using Cepheid reddenings tied to space reddenings and spectroscopic reddenings of Galactic Cepheids (Turner 2001), the results of which can be seen in the data plotted in Figure 6. The addition of U-band observations would have assisted the analysis considerably, but it is important to note that accurate Johnson system U-band observations are difficult to obtain with some CCD/filter combinations (see comments by Turner 2011). Despite that, the success of the present study using both $BV(RI)_C$ and JHK_s photometry should spur further investigations that take advantage of existing survey photometry to study the reddening in interesting Galactic star fields.

The present study was supported in part by research funding awarded through the Natural Sciences and Engineering Research Council of Canada (NSERC), through the Russian Foundation for Basic Research (RFBR), and through the program of Support for Leading Scientific Schools of Russia. This publication makes use of data products from the Two Micron All Sky Survey, which is a joint project of the University of Massachusetts and the Infrared Processing and Analysis Center/California Institute of Technology, funded by the National Aeronautics and Space Administration and the National Science Foundation.

REFERENCES

Benedict, G. F., et al. 2007, AJ, 133, 1810
Berdnikov, L. N. 2007, `http://www.sai.msu.su/groups/cluster/CEP/PHE/`
Caldwell, J. A. R., Cousins, A. W. J., Ahlers, C. C., van Wamelen, P., & Maritz, E. J. 1993, South African Astron. Obs. Circ., 15, 1
Cutri, R. M., et al. 2003, The IRSA 2MASS All-Sky Point Source Catalog of Point Sources, NASA/IPAC Infrared Science Archive
Dean, J. F., Warren, P. R., & Cousins, A. W. J. 1978, MNRAS, 183, 569
Diethelm, R. 1990, A&A, 239, 186
Eggen, O. J. 1951, ApJ, 113, 367
Feltz, K. A., Jr. 1972, PASP, 84, 497