THE WILSON-BAPPU EFFECT FOR Mg II k-LINE EMISSION WIDTHS

M. Parthasarathy

Indian Institute of Astrophysics

ABSTRACT. The existence of a tight linear correlation between the stellar absolute magnitude M_V and the Mg II k-line emission width log $W_{Mg\ II\ k}$ (kms^{-1}) is confirmed using IUE high-resolution (0.2A) data for 100 late-type stars. A least-squares fit to the data gives the relation:

$$M_V = 37.80 - 16.06 \log W_{Mg\ II\ k}(kms^{-1}).$$

1. INTRODUCTION

Several investigators in the recent past have shown that the Mg II k lines are good indicators of chromospheric phenomena in late-type stars. The width and strength of these lines were used to calibrate and correlate with various stellar quantities (Kondo et al. 1976, McClintock et al. 1975, Weiler and Oegerle 1979, Böhm-Vitense 1982, Linsky et al. 1978, Stencel et al. 1980). Weiler and Oegerle (1979), from a Copernicus survey of Mg II emission in 49 late-type stars, found a good correlation between the stellar absolute magnitude and the Mg II k-line width analogous to the Wilson-Bappu effect for Ca II k emission in late-type stars. During the past few years the IUE has produced high-resolution (0.2Å) long-wavelength (2000Å $<\lambda<$ 3300Å) spectra of a large number of late-type stars. The IUE data are less noisy than the Copernicus data.

In this paper the relationship between M_V and log W for the Mg II k line is reported using IUE data for 100 late type stars.

2. DATA

The Mg II k-emission full-line widths were measured near the base of the line in IUE spectra of several late-type stars. Stencel et al. (1980) gave Mg II k-line emission widths for 50 late-type stars from IUE spectra. Garcia-Alegre et al. (1981) gave Mg II k-line emission

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widths for 15 F and G main-sequence stars. The accurate width determination is complicated by the fact that most of the central reversals in Mg II h and k emission lines are due to interstellar absorption or, possibly in some cases, to circumstellar absorption (Böhm-Vitense 1981). Böhm-Vitense (1982) has pointed out that a few peculiar late-type giants have anomalous Mg II h and k line widths. Stars with anomalous Mg II k line widths are not included in the present analysis.

3. M_V - Mg II k EMISSION WIDTH RELATION

In Fig. 1 absolute magnitudes are plotted for 100 stars against log $W_{Mg\ II\ k}$ (kms^{-1}). M_V values based on trigonometric parallaxes or spectroscopic parallaxes were adopted. A least-squares fit to the data gives the relation:

$$M_V = 37.80 - 16.06 \log W_{Mg\ II\ k}(kms^{-1}),$$

with a correlation coefficient which is nearly unity. The relation found in this work confirms the existence of a tight linear correlation between the logarithm of the Mg II k line width and absolute visual magnitude. The high-resolution Mg II h and k line data is now available for several hundred late-type stars from the IUE data bank. If we make use of all this data a more accurate calibration can be derived. In the near future with the Hubble Space Telescope it will be possible to obtain Mg II k line profiles of faint late type stars in galactic clusters, globular clusters and external galaxies. The M_V - log $W_{Mg\ II\ k}$ relation can be an important tool for calibrating the galactic and extragalactic distance scale.

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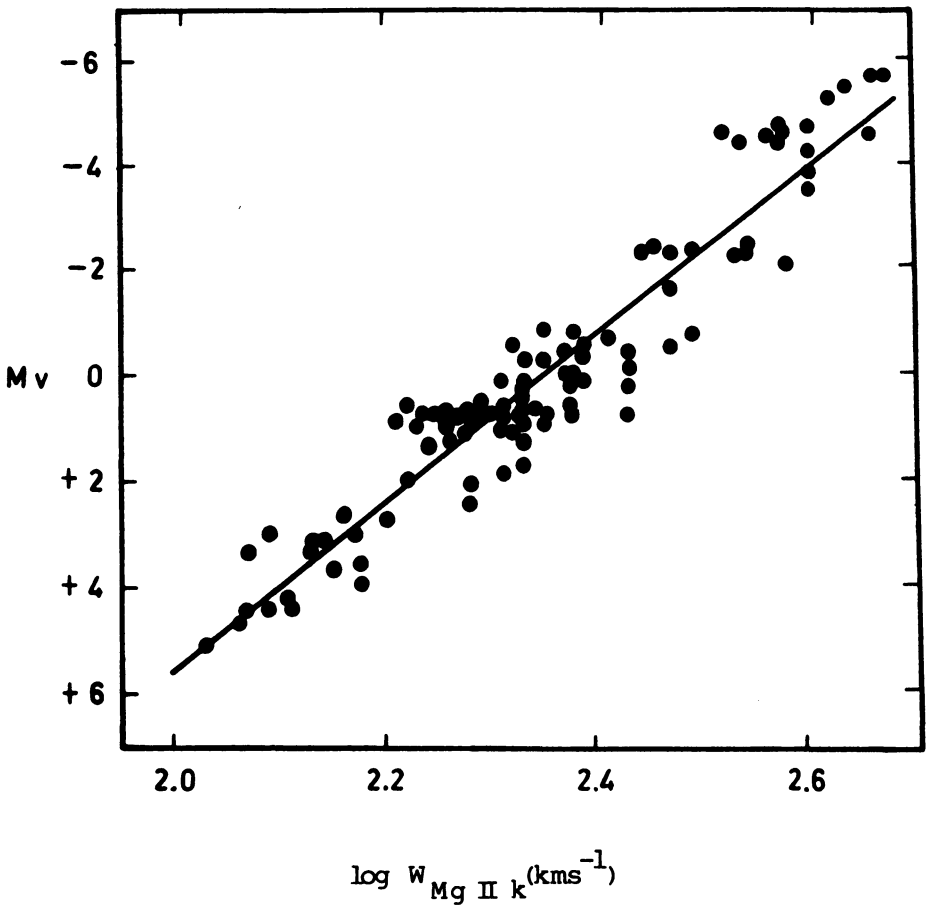

Fig. 1. Absolute magnitude M_v plotted against the logarithm of the emission full width at the base of the Mg II k line, in units of kilometers per second.

DISCUSSION

BESSELL: How were the luminosities determined for the stars used in your calibration?

PARTHASARATHY: I used trig parallaxes or spectroscopic parallaxes.

JASCHEK: I wanted to ask the same question. The scatter in your diagram results from the use of spectroscopic parallaxes, because they are not as good as the trig parallaxes.

PARTHASARATHY: Yes, but we do not have trig parallaxes for many of these stars.

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