The survey of Vaughan and Preston (1980, hereafter VP) of Ca II emission among solar neighborhood stars has shown the distribution of chromospheric emission (CE) of these stars. For stars bluer than \((B-V)=1.50\), it is possible to transform VP's equivalent width \(S\) into a relative flux by use of Middelkoop's (1982) formulae. This enables construction of a chromospheric color-magnitude diagram (illustrated in Soderblom 1982), which shows the same general features as VP's log \(S\) vs. \((B-V)\) plot, except that the CE (as a fraction of the stellar luminosity) declines with mass due to the decline of the ZAMS rotational velocity with mass (Soderblom 1983).

The presence of a gap in this diagram is problematical because a number of effects can contribute to produce systematic trends (Soderblom 1983). What is of interest here is the distribution of CE's for K and M dwarfs, i.e., for \((B-V)>1.0\). The few K-M dwarfs that are extraordinarily strong Ca II emitters are BY Draconis variables or flare stars. The spread in CE for the rest is fairly small: 0.4 dex encompasses all the K-M dwarfs except for a few very weak emitters. As expected, halo population objects have weaker CE on the average than the disk stars do.

\((B-V)\) is a poor temperature indicator for K-M stars. \((V-R)'s\) would be superior but are unavailable for most of VP's stars. To examine the distribution of CE for K-M dwarfs, I have used \((R-I)\) from Gliese (1969). Middelkoop's formulae are not appropriate for such cool stars, so Figure 1 shows log \(S\) vs. \((R-I)\). The F and G stars in this diagram are compressed below \((R-I)=0.40\) \((B-V)\leq 1.0)\). As before, there are BY Draconis and flare stars in the upper right corner. For \((R-I)\geq 0.70\) \((dM2, \(B-V)\approx 1.4)\), the distribution appears to turn over, so that the very weakest stars exhibit weak CE despite the apparent increase in CE that should result from weaker continua. This turnover may be caused in part by VP's continuum bands, which show unexpected behavior for \((B-V)>1.0\) (see Fig. 3 of VP). However, this would affect all stars redder than \((R-I)=0.40\).

The most probable cause of this turnover is the nature of the sample for very cool stars. As Upgren and Armandroff (1981) have shown, our
knowledge of the stellar composition of the solar neighborhood is complete only to about \((B-V)=1.40\) \((M_V=+9)\), i.e., \((R-I)=0.70\). Stars cooler than this tend to be selected on the basis of unusual spectra in objective prism surveys (the BY Dra and flare stars) or because of large proper motions. This latter group tends to be much older than the disk stars. Our knowledge of young to intermediate age stars is poor for low masses.

This conclusion is reinforced by considering the space motions of the stars in Figure 1. If the very active stars are excluded (those with \(\log S>0.50\)), the 47 stars with \((R-I)\geq0.70\) have \(\dot{v}_{\text{rms}}=25\) km s\(^{-1}\), while \(\dot{v}_{\text{rms}}=16\) km s\(^{-1}\) for the 43 stars with \(0.50<(R-I)<0.70\). This latter velocity is typical of the disk population, but 25 km s\(^{-1}\) is appropriate to very old stars (Wielen 1974). Thus a more complete knowledge of K-M dwarfs in the solar neighborhood should turn up stars of moderate CE at all colors.

As Noyes (1983) has shown, the correlation between rotation period and CE is very tight for late-type dwarfs. BY Draconis stars have rota-