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UV Extinction and IR Emission in Diffuse HII Regions

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During this period, much work was spent in an attempt to use theoretical UV line indices as a basis for spectral calibration of the program stars. Figure 1 shows five line indices as functions of effective temperature and log g, calculated with the spectral synthesis programs of Kurucz (1993). Open stars and circles are observed values from Fanelli et al. (1992), using the spectral class - effective temperature calibration of Schmidt-Kaler (1982). We conclude that these line indices may be used to determine an effective stellar temperature, but with uncertainties $\sim$ few thousand degrees. Also, for the hotter stars, theoretical line opacities are systematically low compared to observations.

We have also found that Kurucz (1992) new models appear to represent hot stars very well, even at far-UV wavelengths. This is shown in Figure 2, where two spectra of μ Col (spectral class O9.5 V) are compared to a synthetic spectrum for T_{eff} = 33,000K, log g = 4.0. Also shown (uppermost curve), is an empirical estimate of the intrinsic flux distribution for O9.5 V stars from Papaj, Wegner, & Krełowski (1990).

Using theoretical model spectra as comparison spectra, we have calculated extinction curves for ζ Oph, ξ Per, and σ Sco. These are shown in Figures 3, 4, and 5, respectively. Also shown (dashed curves) are the best fitted model based on a silicate-carbon grain mixture, with independent sets of "large" and "small" grains. The "small" grains are grains in the Rayleigh limit with a radius of 0.005 μm, while the "large" grains correspond to a power law size distribution ($n(a) \propto a^{-3.5}$) with radii in the range of $[a_{min}, a_{max}]$ as indicated. These stars span the range of extinction variations in the diffuse interstellar

medium. We conclude that the curves corresond to a sequence of decreasing numbers of intermediate size grains (0.01 - 0.04 μm) being present. Also, the position of the 4.6 μm^{-1} extinction hump indicates a simultaneous increase in the numbers of small and oblate graphite grains.

Calculations allowing organic refractory mantles on the silicate grains or substituting amorphous carbon grains for the graphite grains in all instances give worse fits to the observations. A small admixture of PAHs ($\sim$ few percent) improves the extinction fit only in the case of ζ Oph.

A poster paper reporting the results of these investigations was presented at the 183rd American Astronomical Society meeting in Washington D.C. 11 - 15 January, 1994 (Bull. AAS., Vol. 25, No. 4., 1312).

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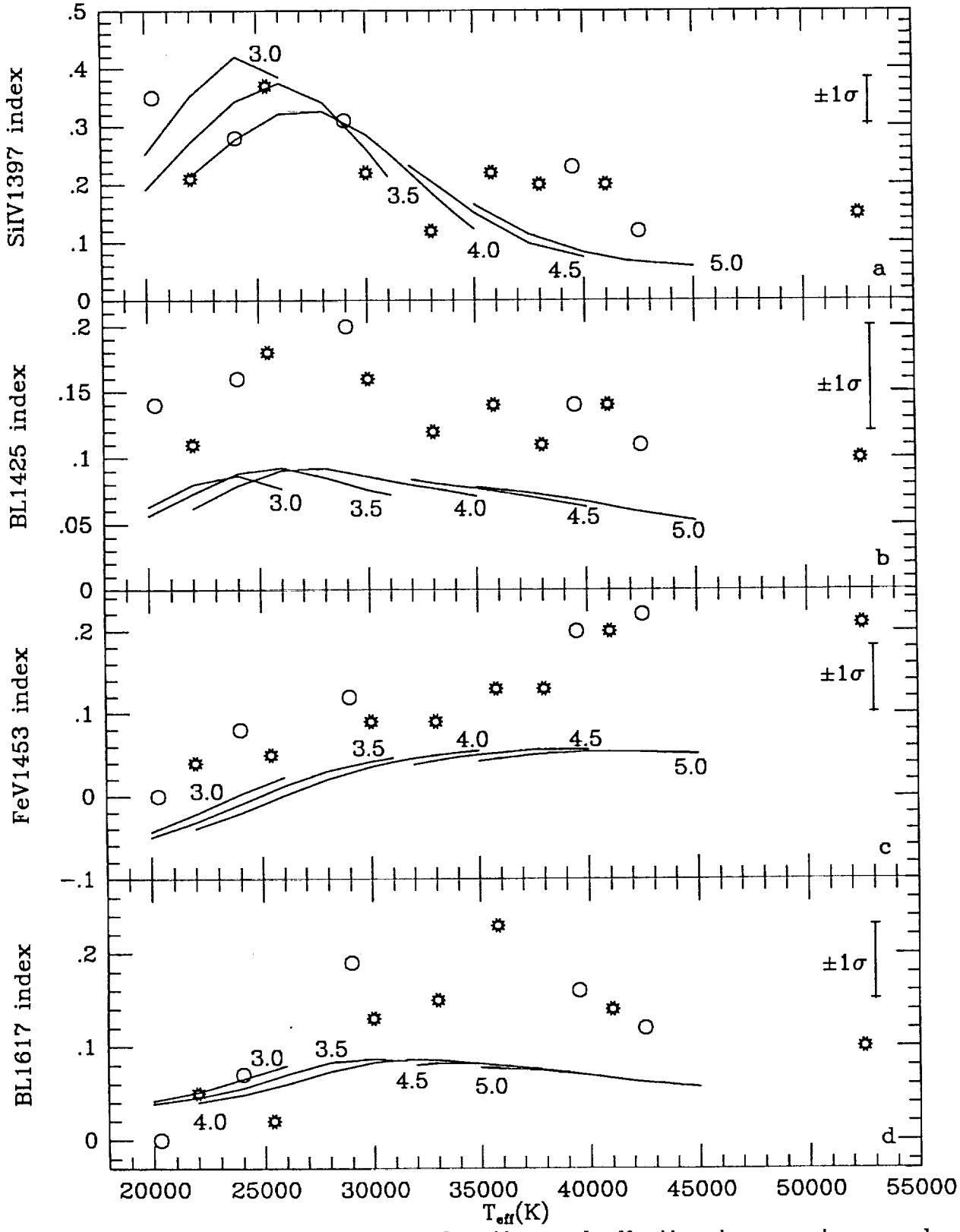

FIG1.– UV line indices as functions of effective temperature and log g. Curves, synthetic indices calculated from Kurucz (1993) models with log g as indicated. Open stars, observed main sequence stars. Open circles, observed giant stars. (Observed values from Fanelli et al. 1992). Error bar, estimated uncertainty in observed line index.

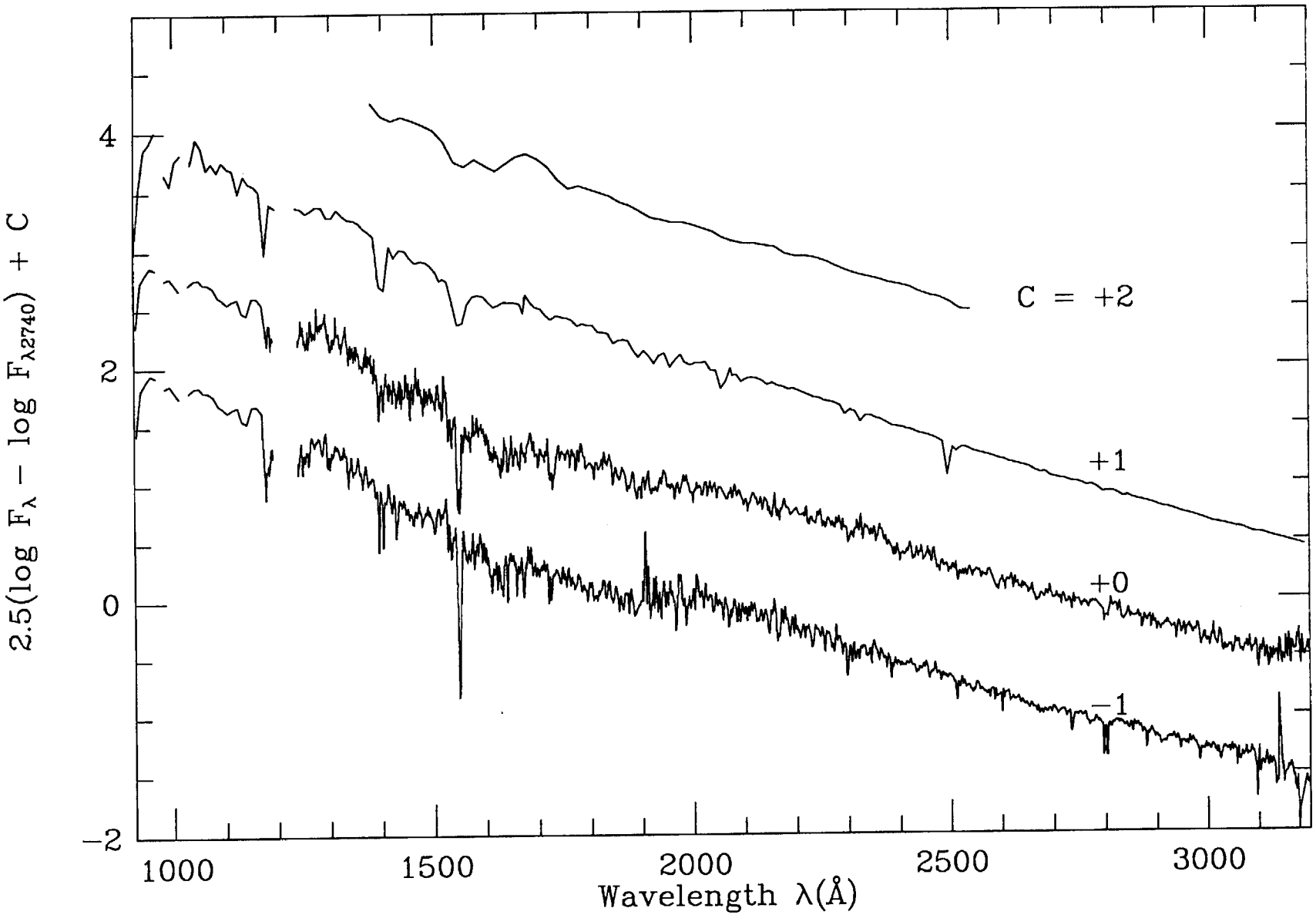

FIG.2– Two lower curves, μ Col spectra from Table 1 (lower one is binned high–resolution spectrum). Next higher curve, Kurucz model spectrum for T_{eff} = 33,000K, log g =4.0. Top curve, intrinsic flux distribution for 09.5 V stars (Papaj, Wegner, & Krelowski 1990).

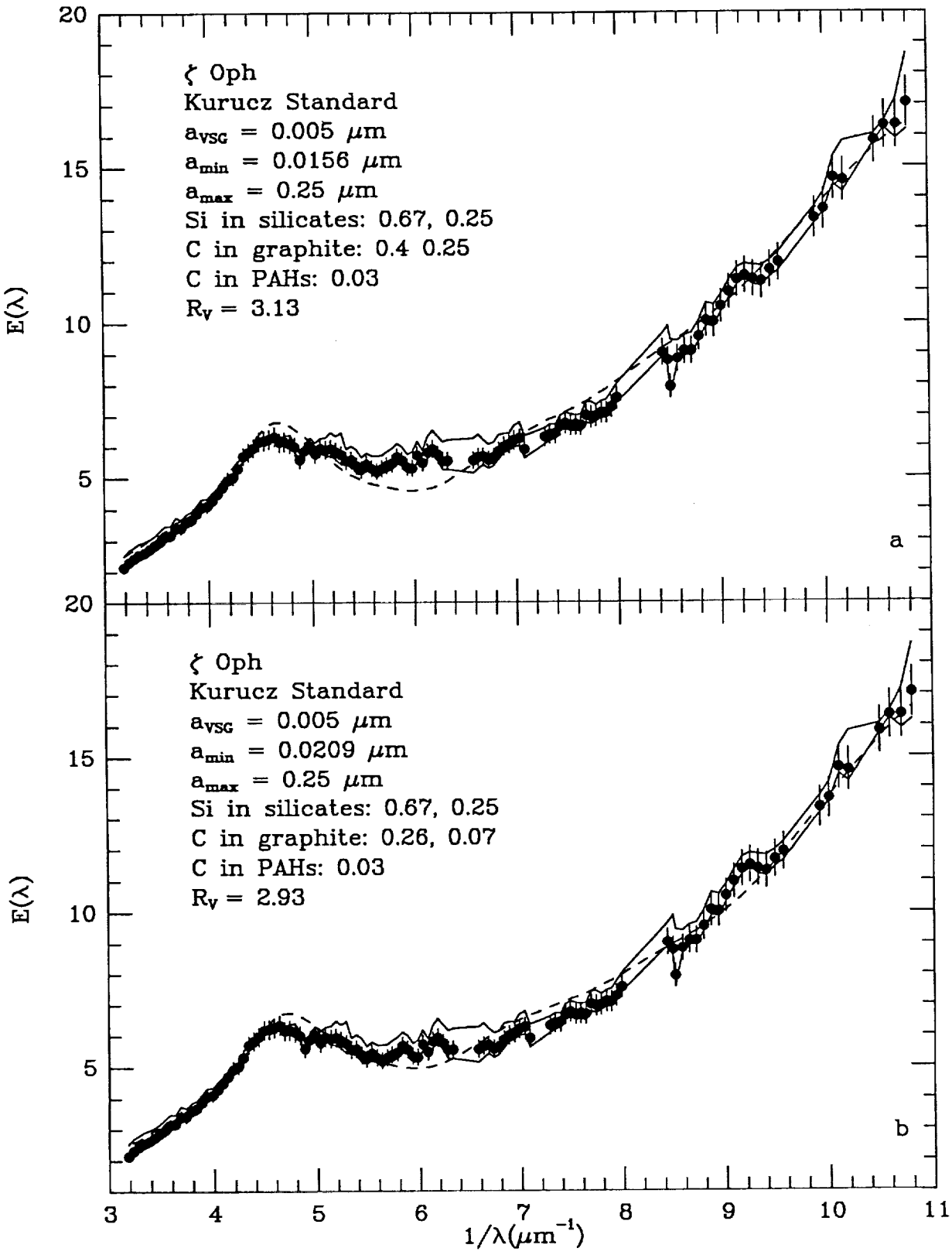

FIG.3– Dashed curves, χ^2–fits to coadded normalized extinction data. Bars show 1σ observational random errors. Solid curves, observed extinction curves for a comparison model variation of ±2,500K in T_{eff}, ±0.25 in log g. Dust model parameters as indicated. Si and C values refer to fraction of cosmic abundances tied up in larger grains and in the very small grains, respectively. R is the model value for the ratio of visual to selective extinction.

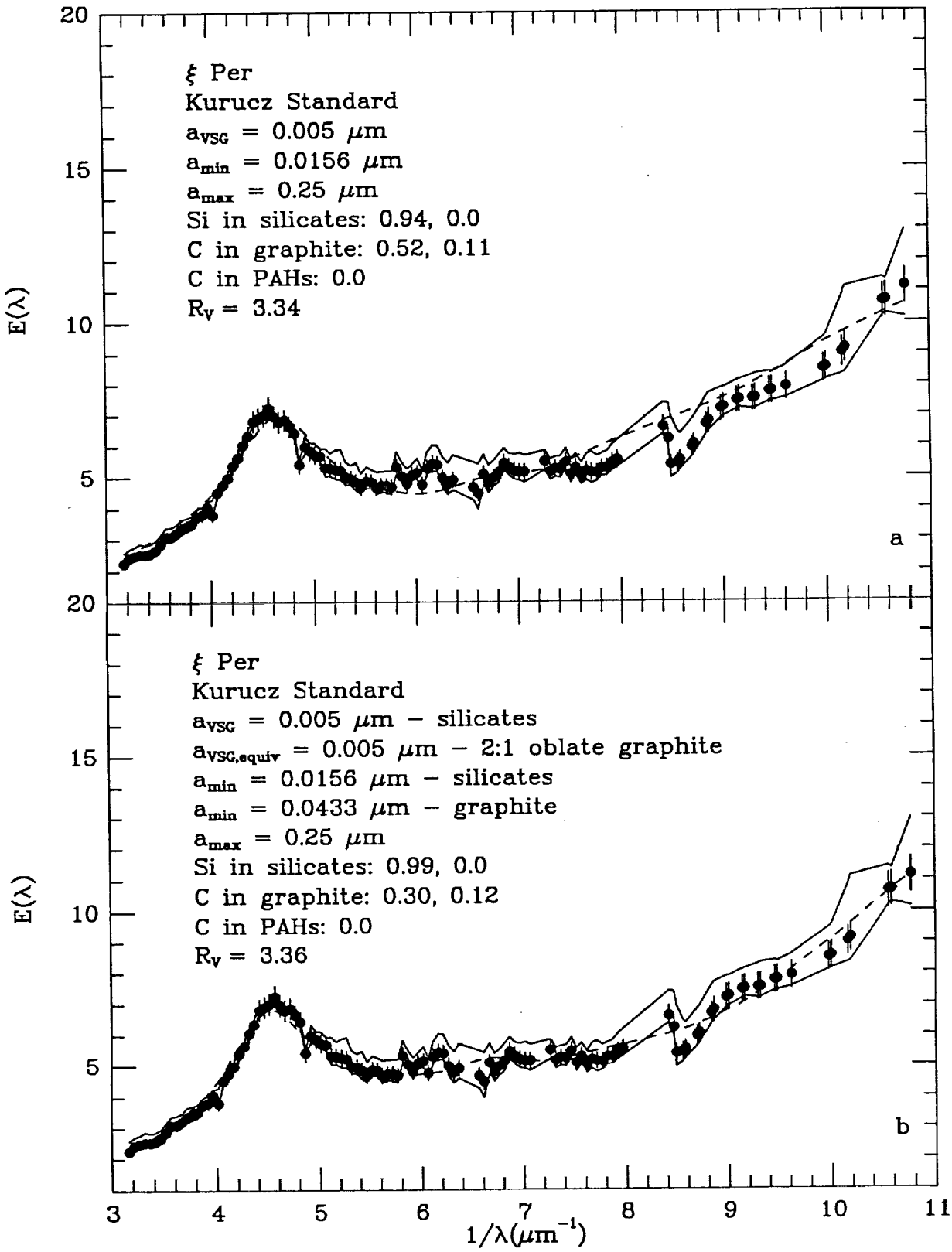

FIG.4– χ^2–fits to coadded extinction curves. Notation as in Figure 3.

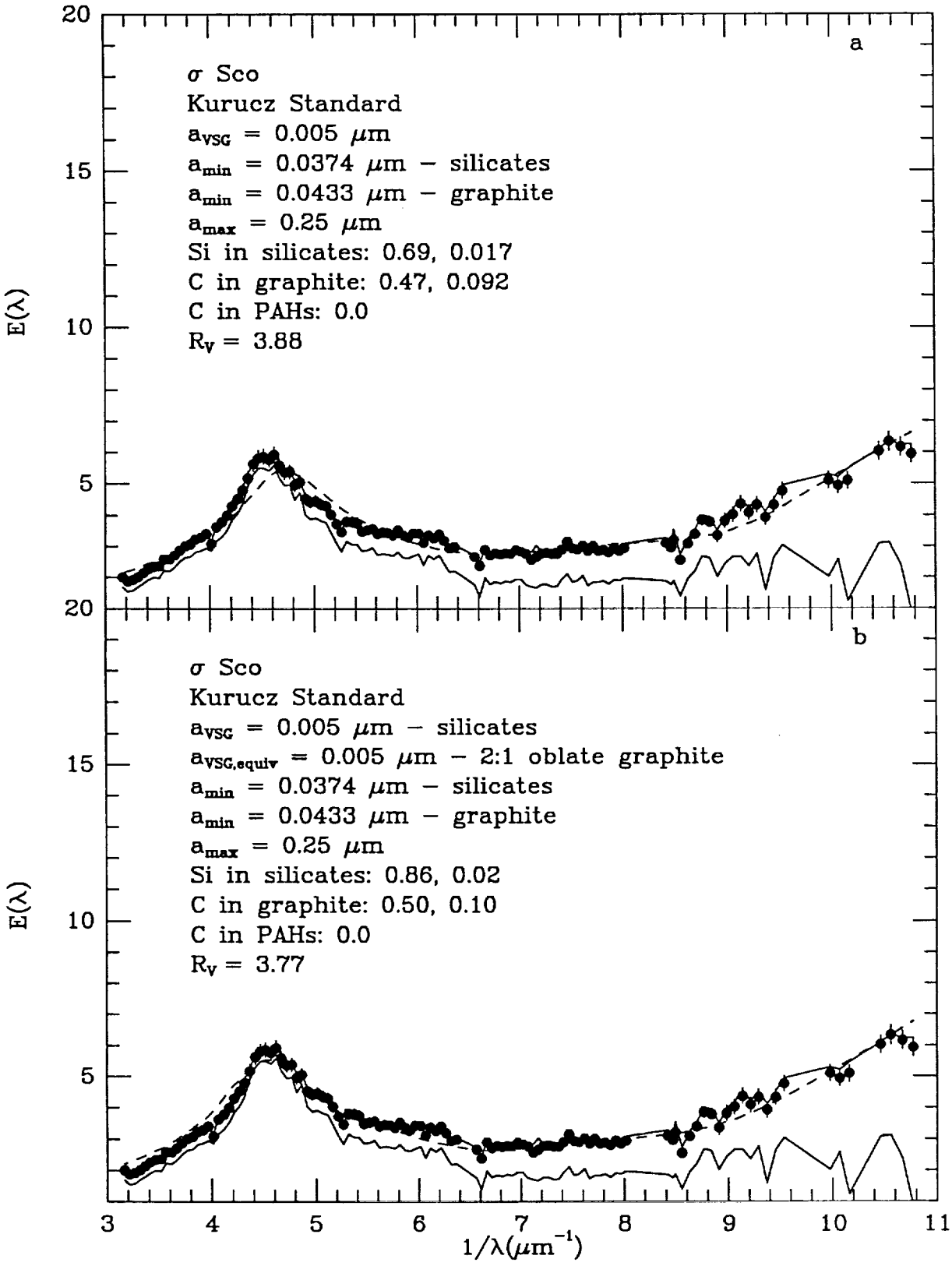

FIG.5– χ^2–fits to coadded extinction curves.
Notation as in Figure 3.