

#### 7.4.2 Deriving Errors Using Night-to-Night Deviations in the Comparison Star Light Curves

Since we expect the differential intensity to be zero for stars from one observing run to the next, we can use the run-to-run (or night-to-night) deviations as an estimation of the non-formal errors in category (2) described above. In this case, we have considered the deviation of each point from the mean of all points *not* on the same night. Once again, the distributions have been binned into divisions based on the calculated error ( $\sigma_{CE}$ ) which includes  $\sigma_{NF}$  derived above. A selection of these distributions along with Gaussian fits are shown in figure 7-6 . The additional error is plotted in the lower-right graph of figure 7-6 as a function of calculated error (  $\sigma_{AE}^2 = \sigma_T^2 - \sigma_{CE}^2$  ). In this case, we have neglected the error in the means since a large number values were used in the calculation of the means (  $\gtrsim 9$  ).

Since  $\sigma_{AE}^2 > 0$ , images from the same night must be correlated relative to images from other nights. This correlation is due to the fact that often sequential images were taken without moving the position of the star field on the CCD, and the fact that the same flat-field division and same hot pixel subtraction is used for images from the same night. We must combine  $\sigma_{AE}$  with the error of the light curve points averaged from each night. In other words, since the same night data are correlated, the additional error does *not* decrease as  $1/\sqrt{N}$ , where  $N$  is the number of images from a given night.

#### 7.4.3 Final Check of the Night-to-Night Deviations

After calculation of the image-to-image light curve, points from images taken on the same night were averaged. Points deviating by more than  $4\sigma$  (based on our adjusted errors) from the mean were rejected. The additional error (described above) is included in the total error:  $\sigma_{TE}^2 = \sigma_{ACE}^2 + \sigma_{AE}^2$ , where  $\sigma_{ACE}$  is the error in the same night average (  $\sigma_{ACE} \simeq \sigma_{CE}/\sqrt{N}$  ). The additional error is given by the formula:  $\sigma_{AE} = 0.87 + 0.62\sigma_{CE}$  (see figure 7-6 ), where  $\sigma_{CE}$  is the median calculated error of the averaged images.