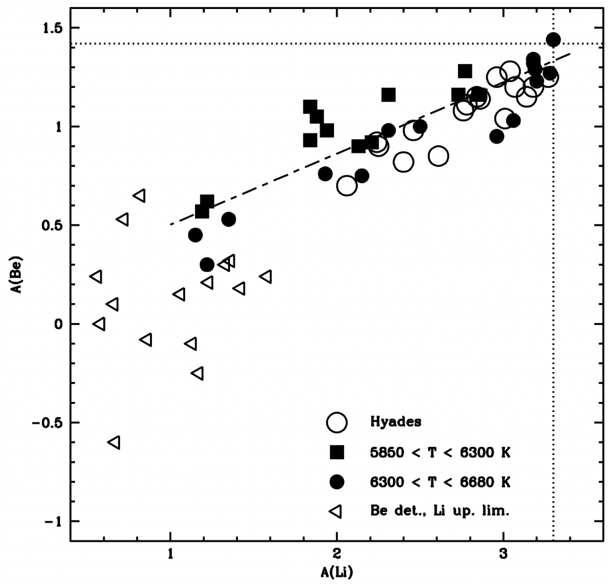
# AST 475/875 Homework #3

*Due F, Sept 3rd in class*

Using $\chi^2$ for Astronomical Hypothesis Testing

Boesgaard & King (2002) looked at correlations between Be and Li in Hyades open cluster F and early G dwarfs. The plot to the right shows the Hyades data in the temperature range 5850-6680 K as open circles. Previous field star results are shown as solid squares and circles, and they are alleged to show the relation A(Be)=0.359×A(Li) + 0.146 shown as the dashed line in the figure.




Use the table of Hyades data below, to address the following:

a) Use a $\chi^2$ test to test the hypothesis that the Hyades data follows the field star-defined relation. Namely, with what quantitative confidence can you say that the field star relation fits the Hyades data?

b) Regardless of the actual result, if the Hyades data were not well-fit by the field star relation as determined from the $\chi^2$ test, briefly describe how you might develop a feeling for whether an alarmingly high $\chi^2$ value is due to a) an inappropriate choice of fitting function, or b) too much scatter about an otherwise adequate fitting function?

| Star | A(Li) | σ | A(Be) | σ |
|---|---|---|---|---|
| vB 10 | 2.76 | 0.05 | 1.08 | 0.05 |
| vB 19 | 3.01 | 0.05 | 1.04 | 0.09 |
| vB 31 | 2.96 | 0.05 | 1.25 | 0.05 |
| vB 48 | 3.04 | 0.05 | 1.28 | 0.09 |
| vB 59 | 2.86 | 0.05 | 1.14 | 0.06 |
| vB 61 | 3.18 | 0.05 | 1.20 | 0.10 |
| vB 62 | 3.14 | 0.05 | 1.15 | 0.05 |
| vB 65 | 3.07 | 0.05 | 1.20 | 0.06 |
| vB 66 | 2.78 | 0.05 | 1.11 | 0.06 |
| vB 77 | 2.46 | 0.05 | 0.98 | 0.10 |
| vB 78 | 2.61 | 0.05 | 0.85 | 0.10 |
| vB 81 | 2.24 | 0.05 | 0.92 | 0.10 |
| vB 86 | 2.40 | 0.05 | 0.82 | 0.10 |
| vB 113 | 2.84 | 0.05 | 1.15 | 0.06 |
| vB 121 | 3.27 | 0.05 | 1.25 | 0.07 |

| | | | | |
|---|---|---|---|---|
| vB 124 | 2.06 | 0.05 | 0.70 | 0.10 |
| vB 128 | 2.25 | 0.05 | 0.90 | 0.10 |

Note/Tip: You have uncertainties in the x coordinate here? How do you treat these—i.e., how would you include them in a $\chi^2$ test that only looks at the y residuals? A “trick” that is often done (rightly or wrongly) is to “convert” the x uncertainties into an additional y uncertainty via the slope of the y versus x relation: sigma (y)’ = slope * sigma (x) and then add the “y” uncertainties in quadrature thusly: [sigma(y) total]$^2$ = [sigma(y)]$^2$ + [sigma(y)’]$^2$