Measuring the Accuracy of Chandra/HETGS Wavelength Scale

with Capella data

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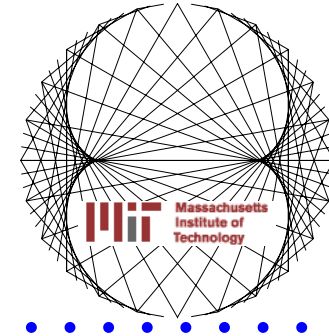
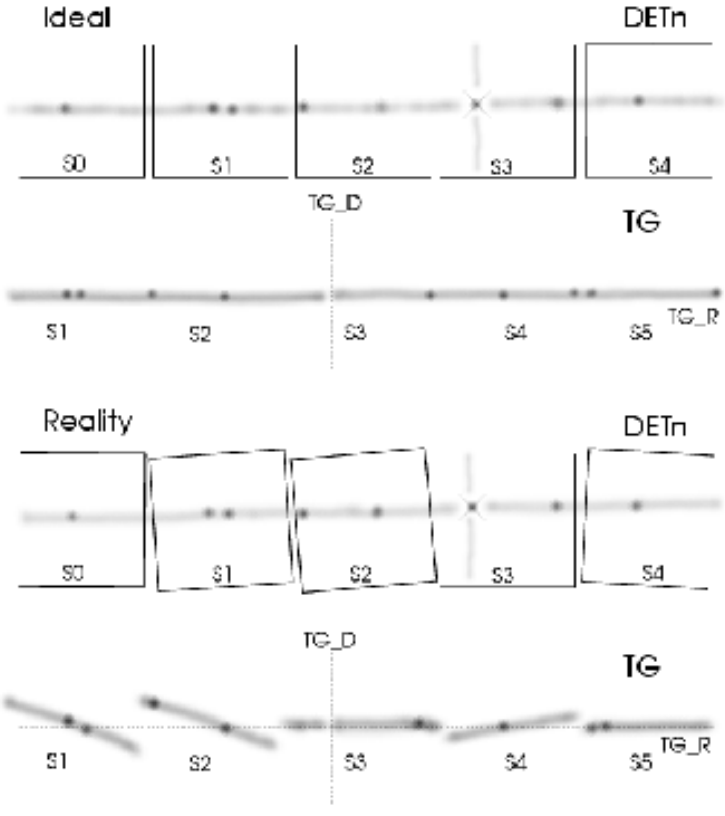


Calibration of ACIS-S Geometry

- Correct Anomalous Rotation of ACIS-S Chips
- Correct Translational Offsets of the Chips
- Adjust MEG Grating Period (4001.41 to 4001.95AA)



Poor Chip Geometry

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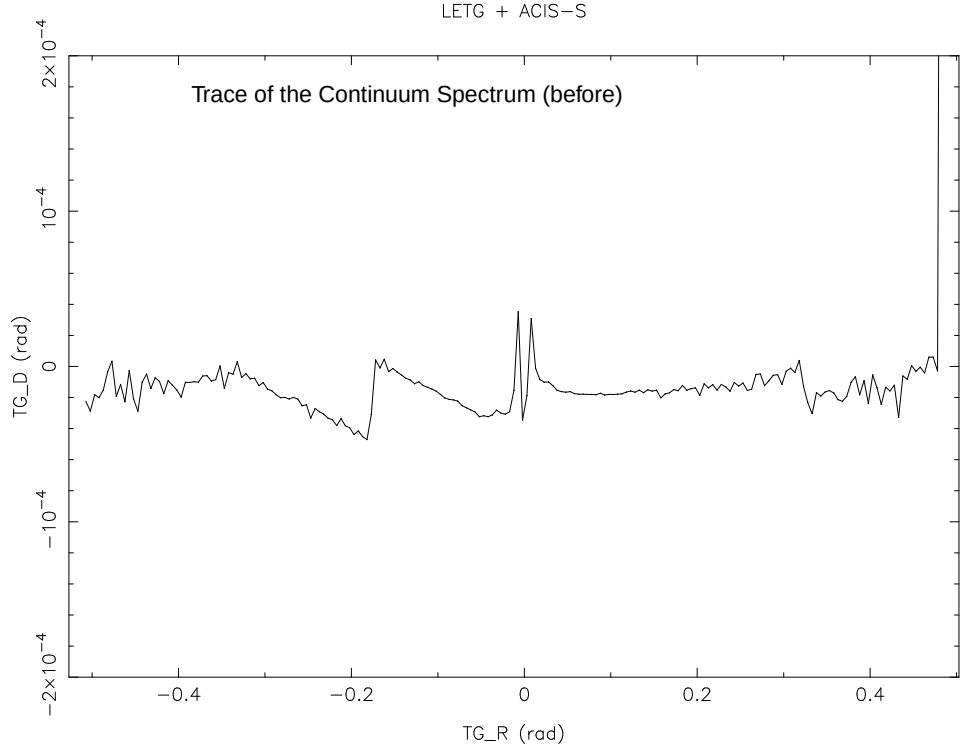

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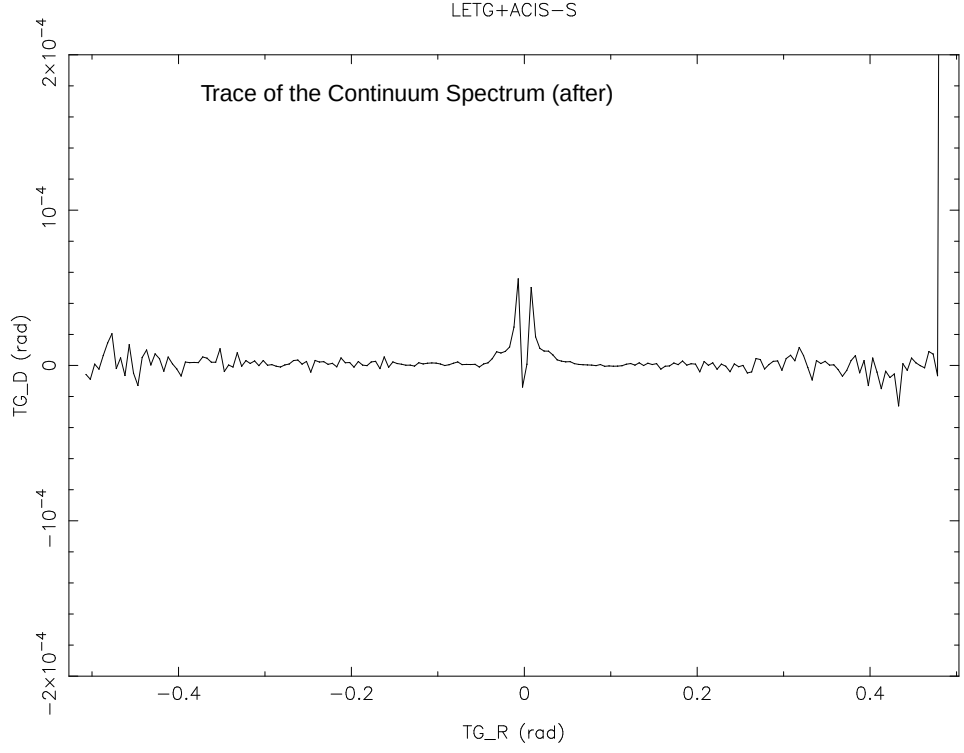

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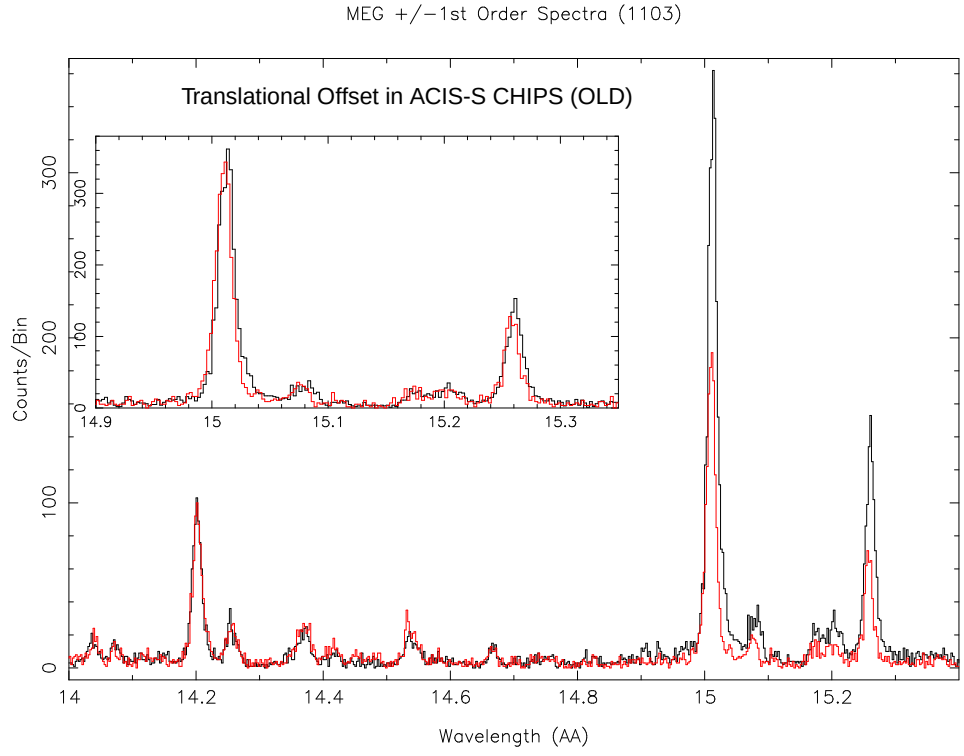

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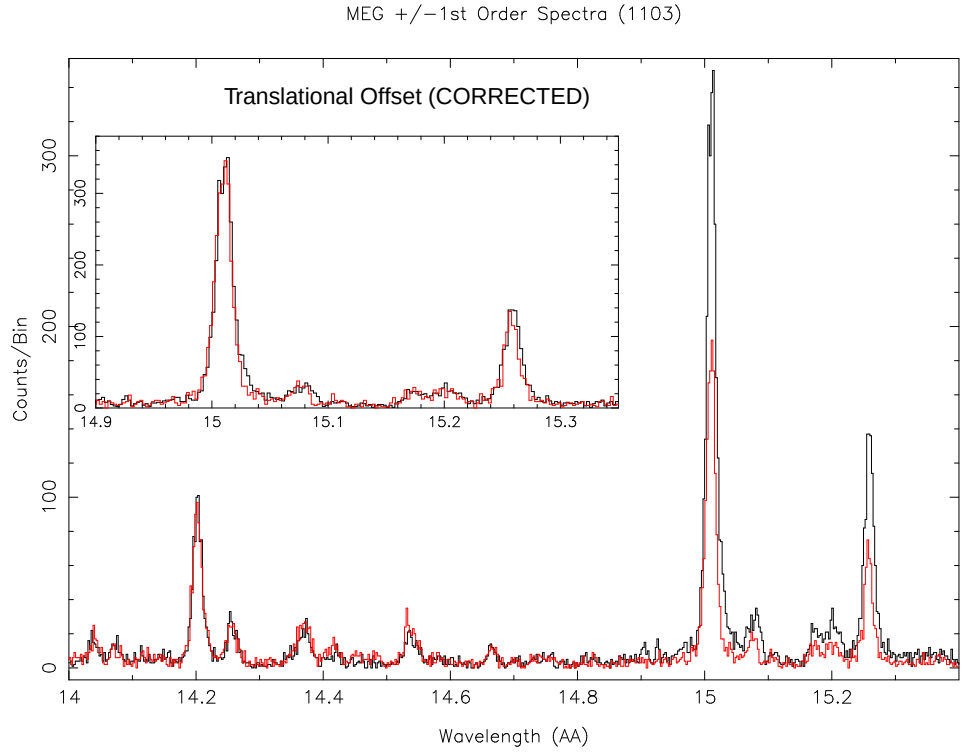

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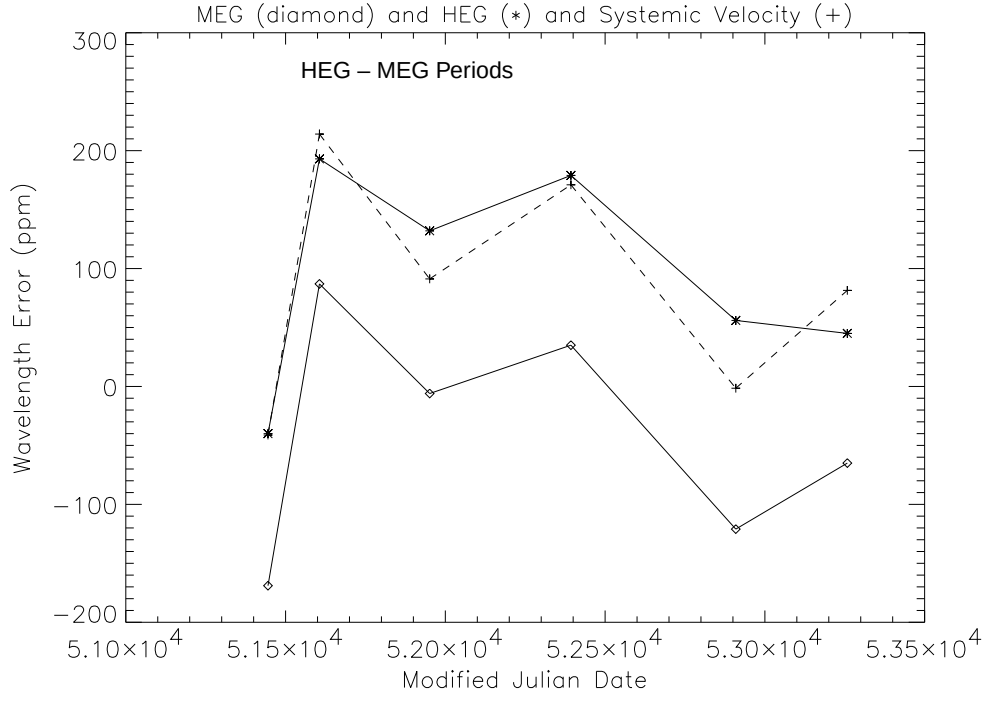
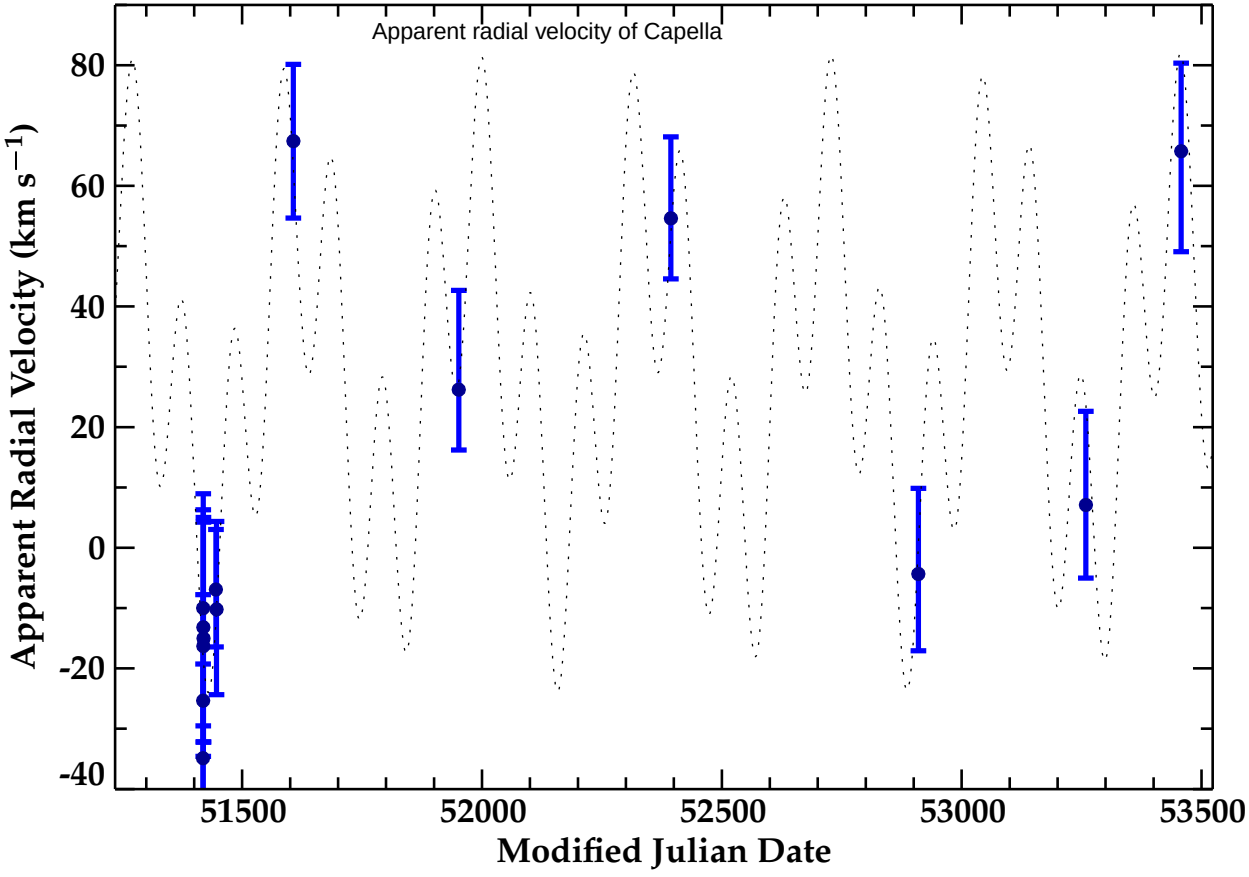


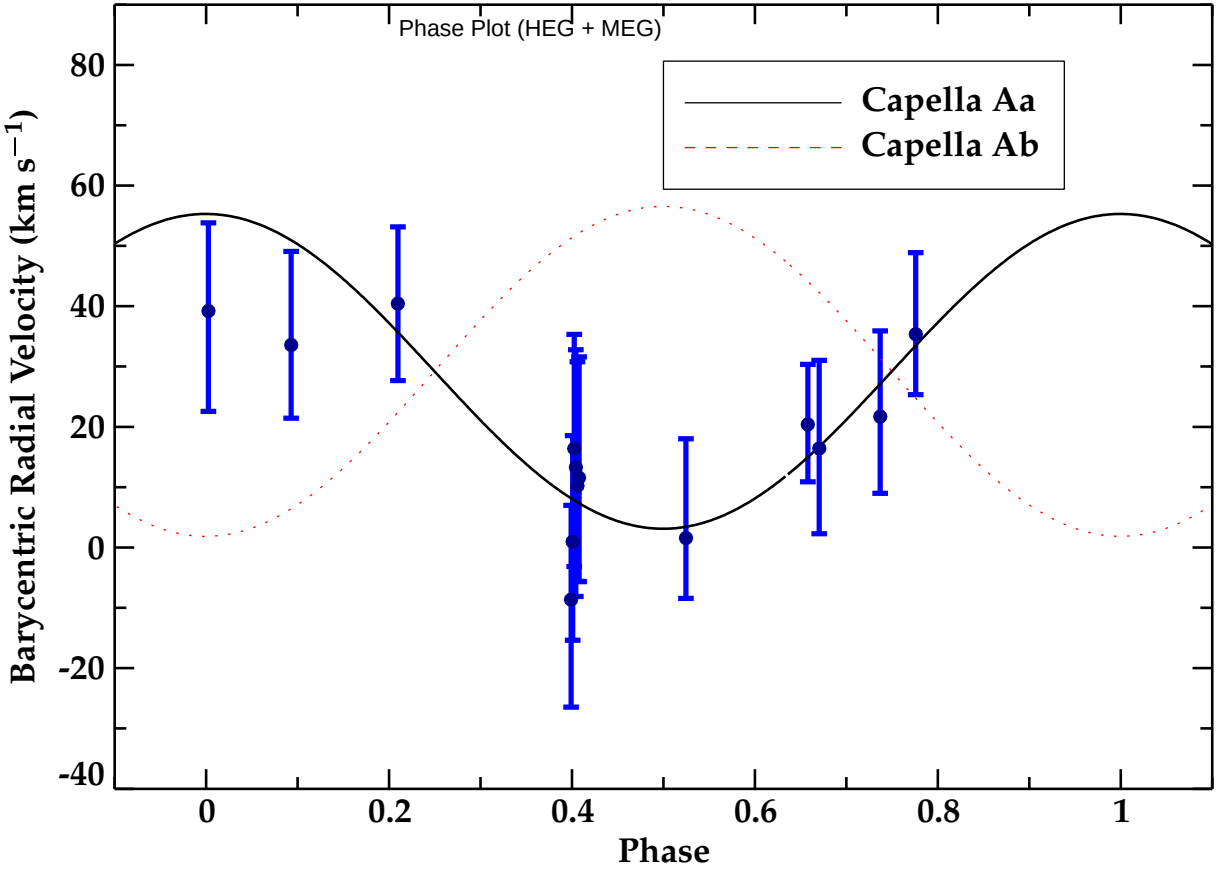
CAL Observations of Capella

- Fit APED model (better handle on blend lines) for each of four grating settings
- Select several bright emission lines (e.g., Si XIV, Mg XI & XII) for fitting



CAL Observations of Capella

- Capella Aa and Ab: two cool giants of G8 III ($2.6M_{\odot}$) and G1 III ($2.5M_{\odot}$)
- Period $\approx 104^{d}$, Systemic Velocity K $\approx$ 29km/s



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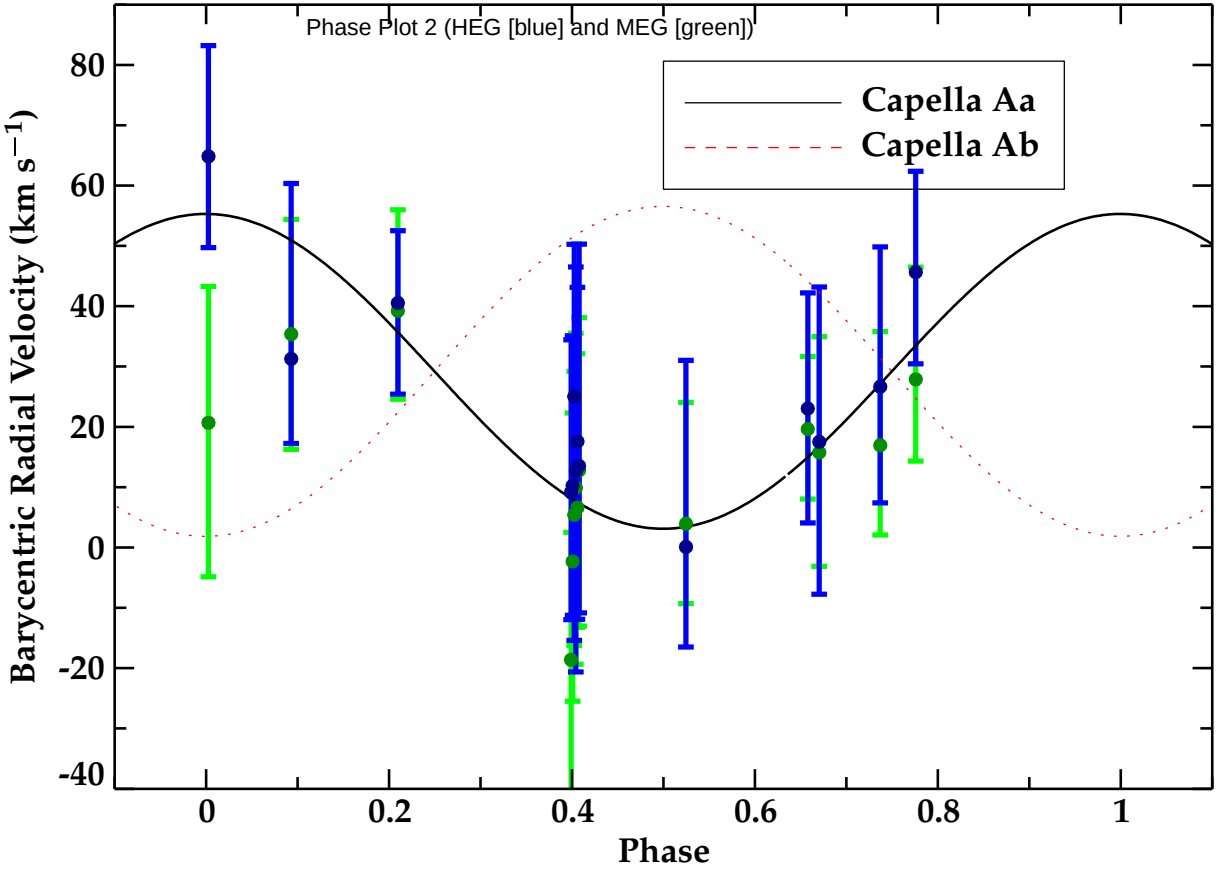
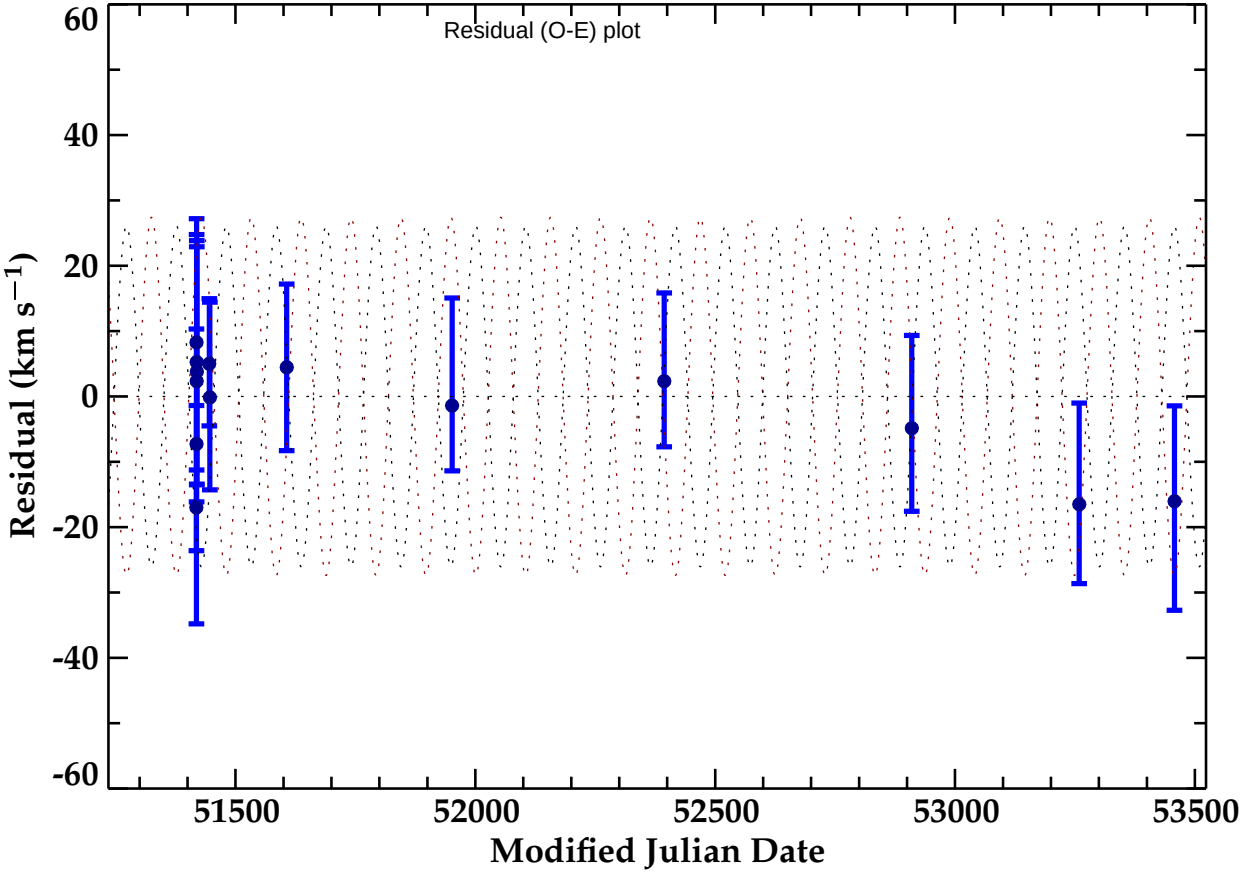


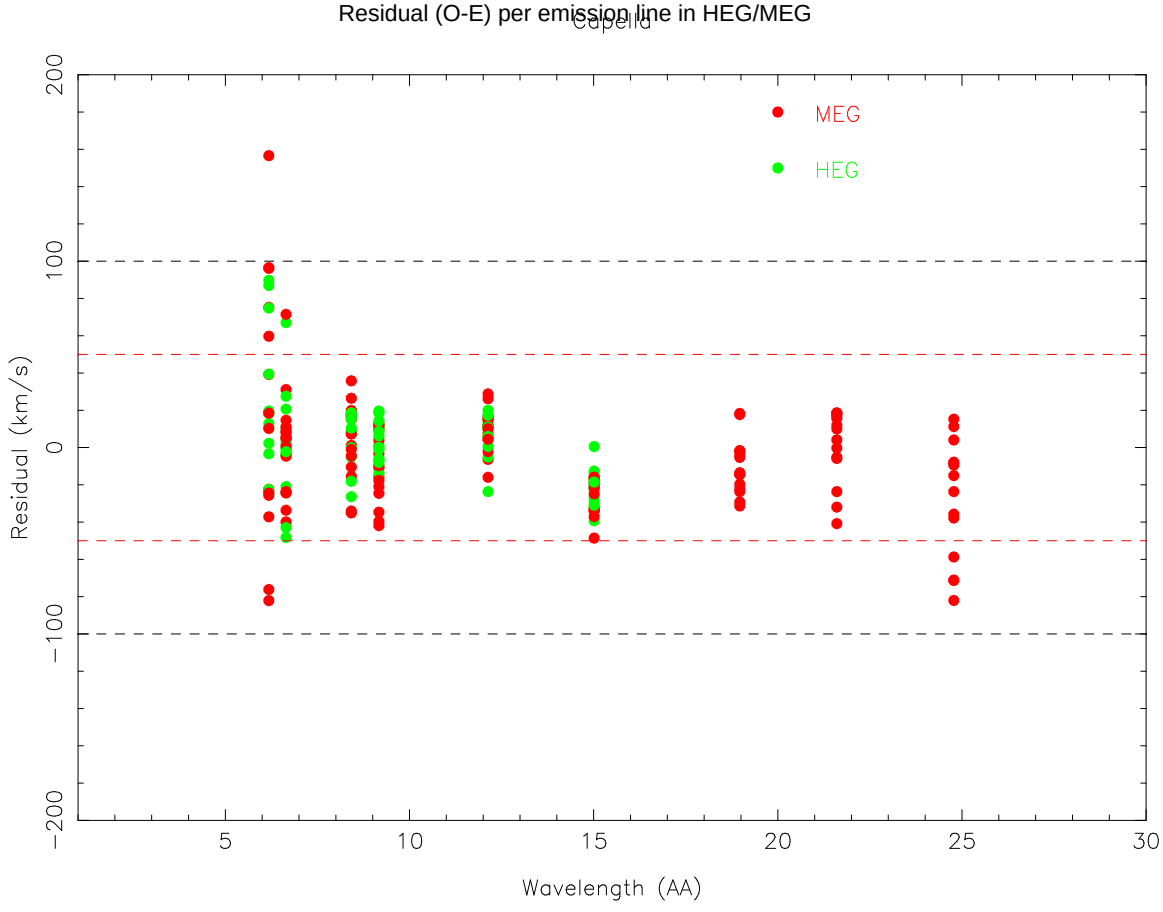
CAL Observations of Capella

- Residual (Observed - Expected) $\leq$ 20 km/s (too large to be due to defocusing)



CAL Observations of Capella

- Residual per wavelength $\approx$ 100km/s (3σ)
- $\delta\lambda/\lambda \approx 1 \times 10^{-4}$



Summary

Calibration:

- HETGS appears very stable in a long term.
- Achieving [*absolute*] wavelength accuracy of 100 km/s for both HEG and MEG gratings per wavelength.
- Enabling to probe a Doppler scale variation of 20km/s in an astrophysical object.
- The mysterious trend in the residual plot: calibration issue? or just systemic error?

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Science:

- The mysterious trend...Science issue? (need a follow-up?)
- Why do these similar cool giants – G8 III and G1 III – *NOT* contribute equally in X-rays?