Robust transition probabilities from solar spectrum

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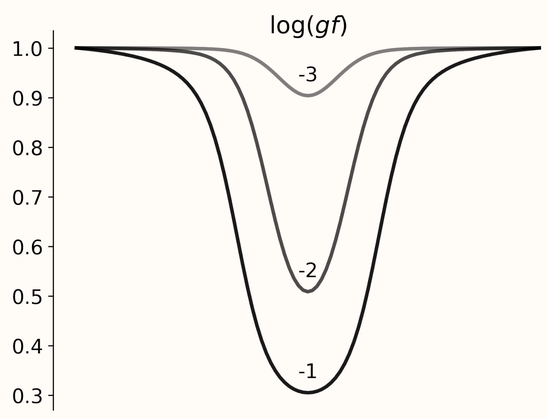
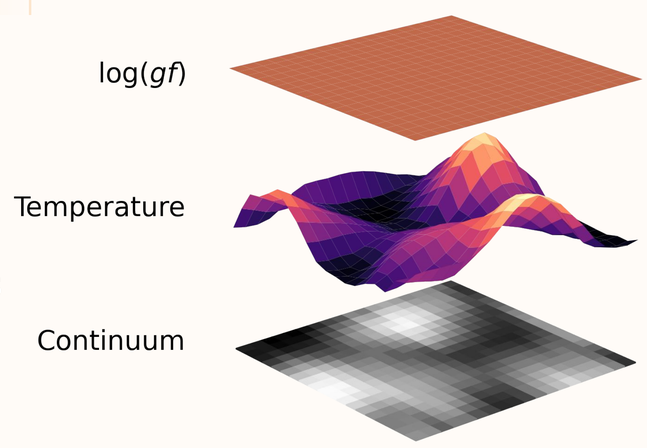
Motivation

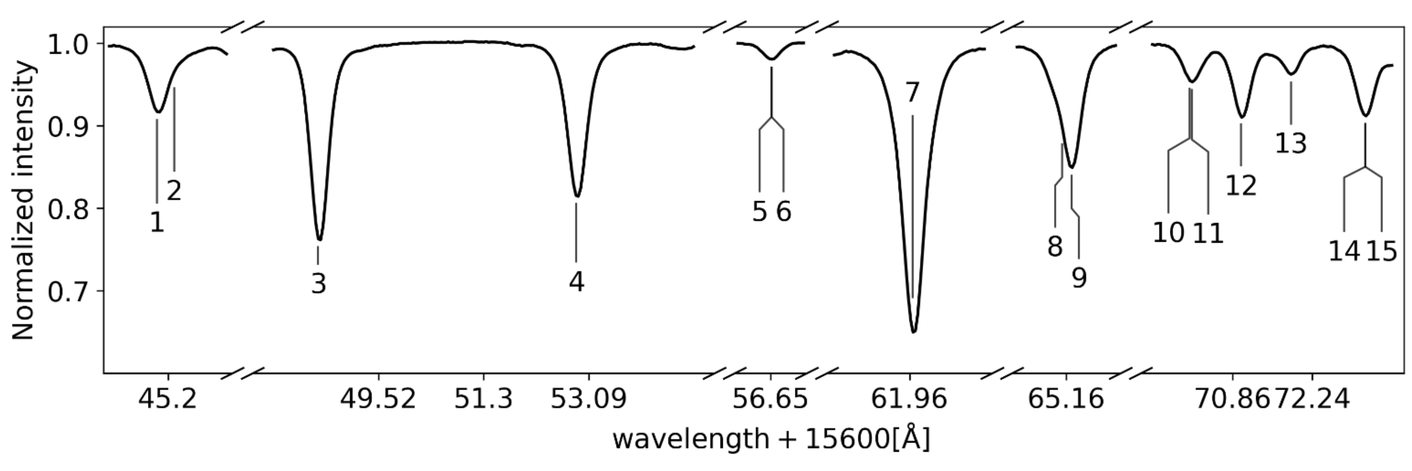
Only a handful of lines have transition probabilities, *log(gf)*, known with high accuracy. Improvements in the log(gf) are of highest relevance to probe the solar atmosphere and measure stellar chemical composition.



Method

Simultaneous inference of atmospheric and log(gf) parameters. Transition probability is spatially invariant parameter. Line 3 is used as a reference line to infer the log(gf) of all other lines [Fig. 1].





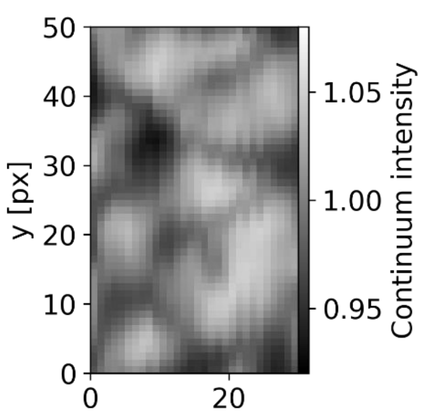
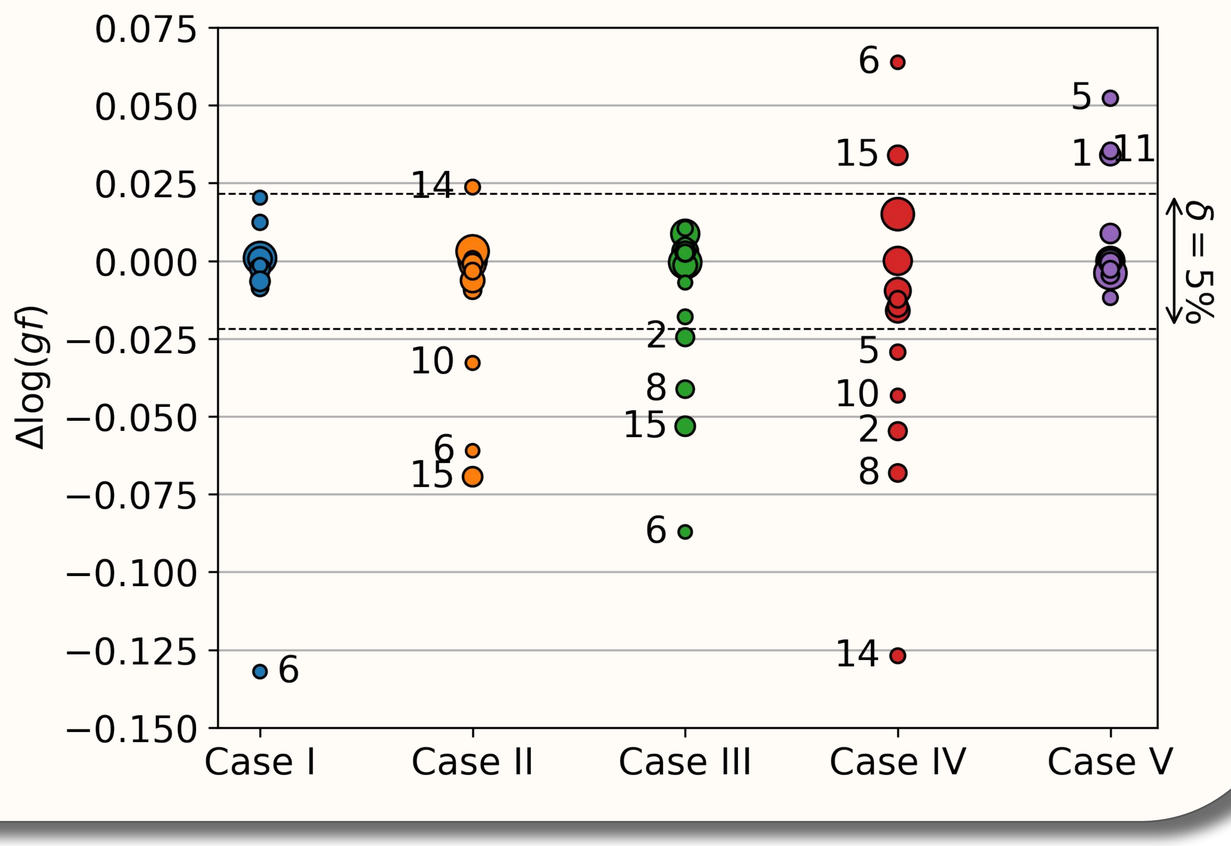


Figure 1. spatially resolved spectropolarimetric data of a quiet-sun region at 1.56 μm from GRIS/GREGOR spectrograph. Identified 15 spectral lines [Fig. 1]. Only line 3 has accurate log(gf).

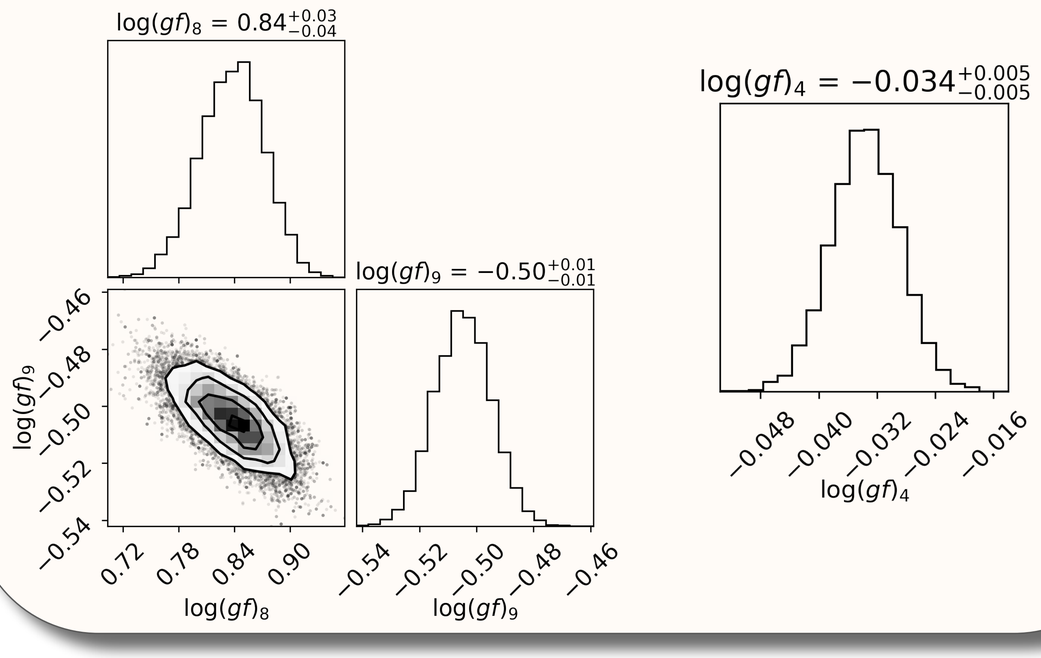
Robustness tests

Comparing the determined log(gf) by those determined from:

- **Case I.** selecting a different field of view
- **Case II.** increasing the amount of spectral stray light
- **Case III.** changing the reference line (to line 7)
- **Case IV.** reparameterisation of atmospheric model
- **Case V.** without weak blend companions (2, 6 and 10)



Uncertainty measurements with MCMC



Conclusions

- results show strong robustness against incomplete data reduction and atmospheric reparameterisation
- strong and isolated lines uncertainty of ~3% (comparable with the experimental measurements that are mostly <10%).
- weak and blended lines have uncertainties of ~10%
- we can provide transition probabilities of high accuracy for many lines using solar observations

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link to paper draft