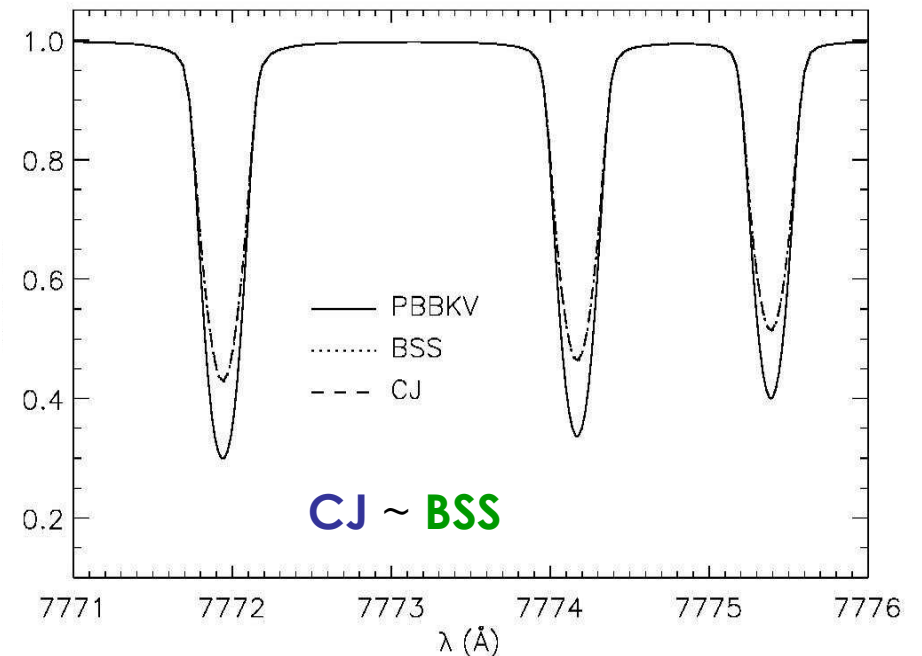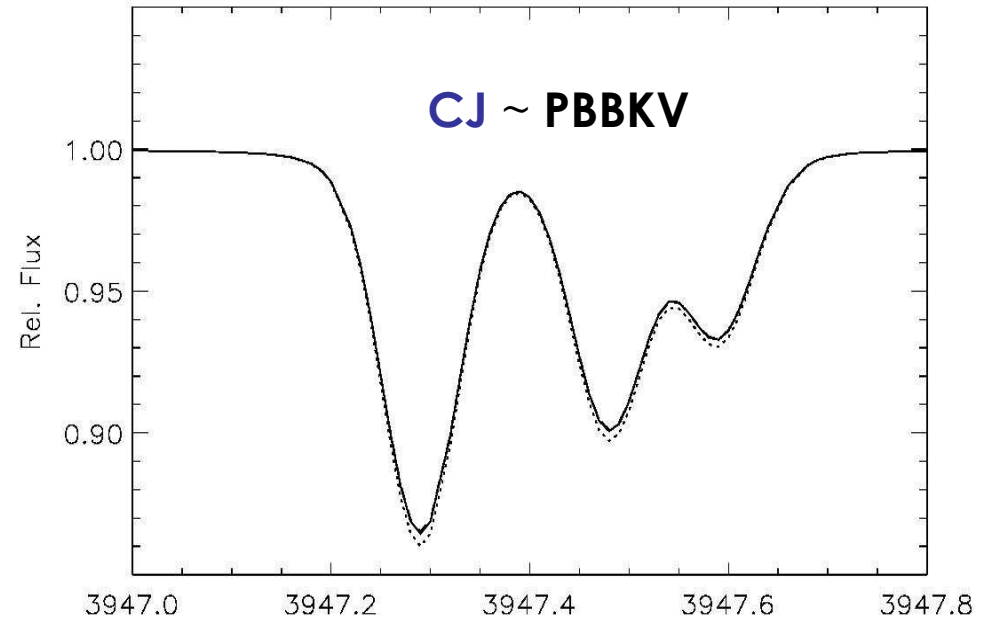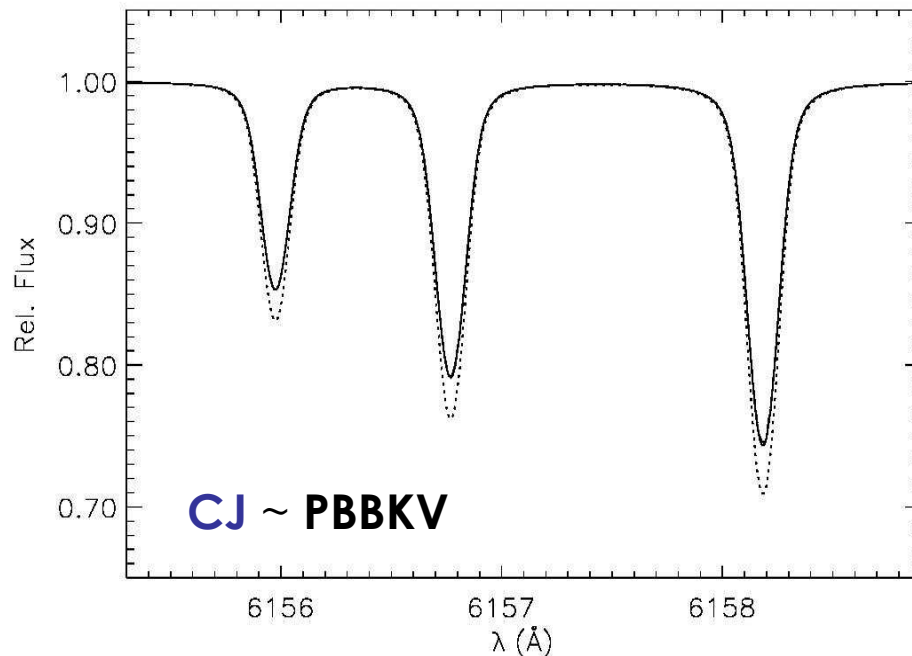# 3a) Solutions

Vega

different model atoms can

- produce lines of different strength

- give similar results for some lines at one set of physical parameters ...
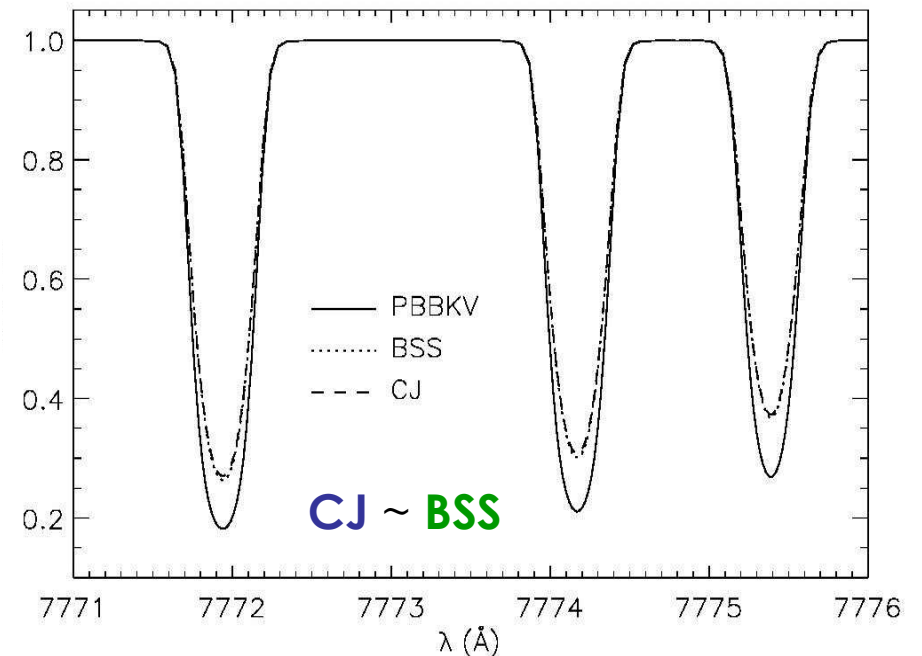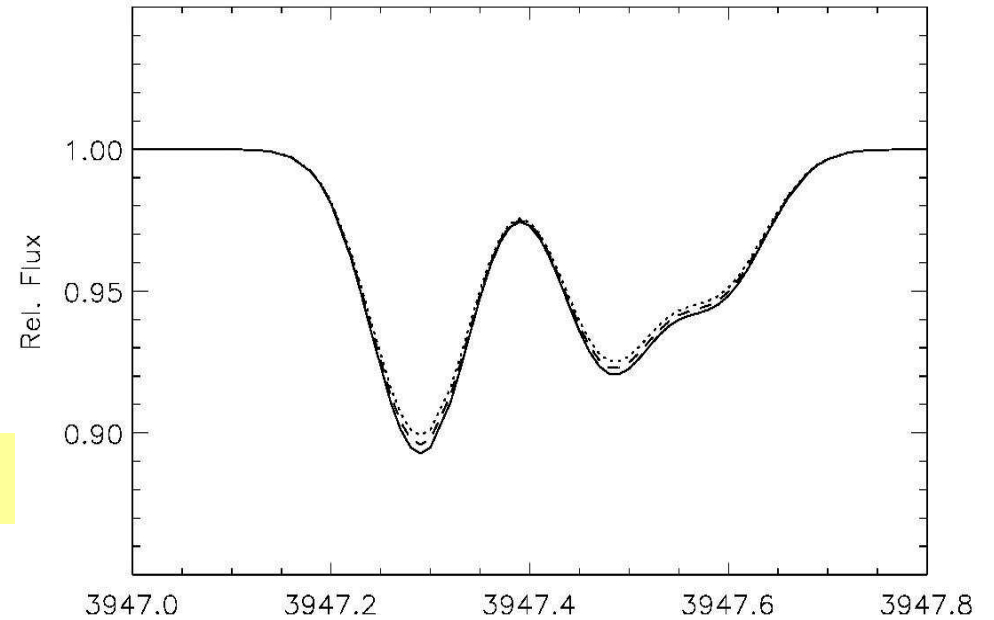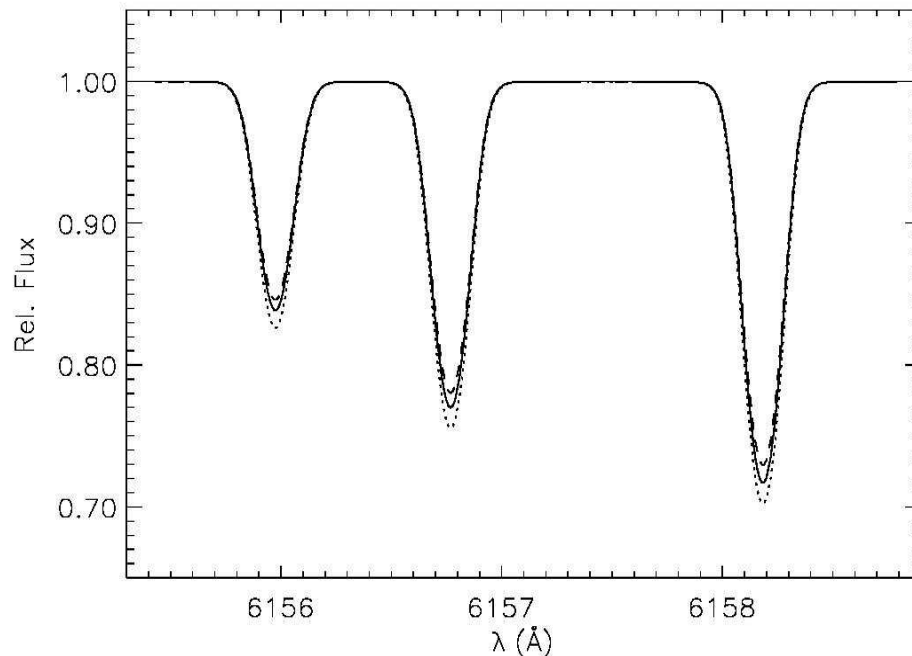

CJ ~ PBBKV

CJ ~ PBBKV

PBBKV
BSS
CJ

CJ ~ BSS

3a) Solutions

SG

- ... but discrepant results for the same lines at another set of physical parameters

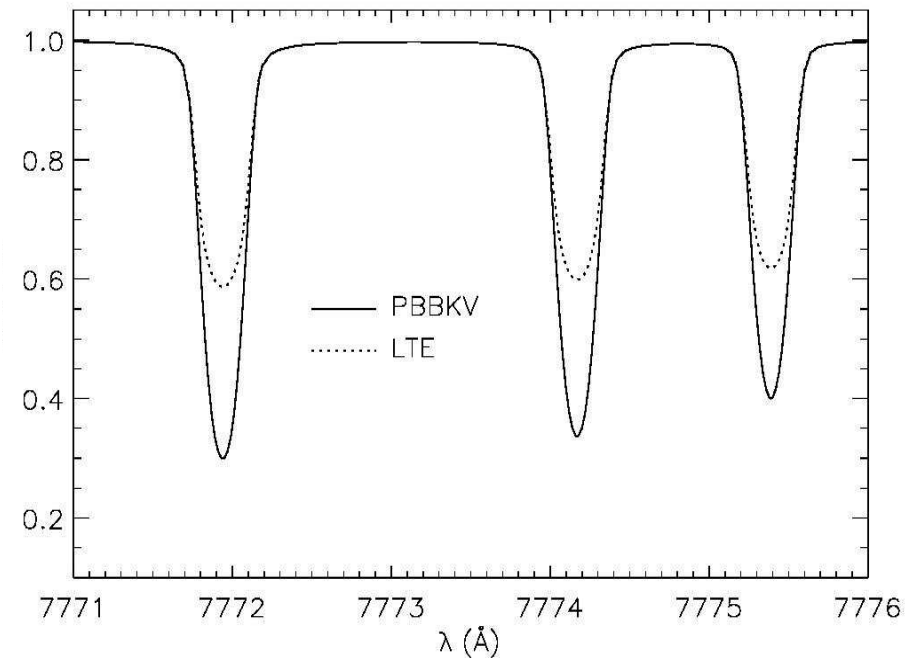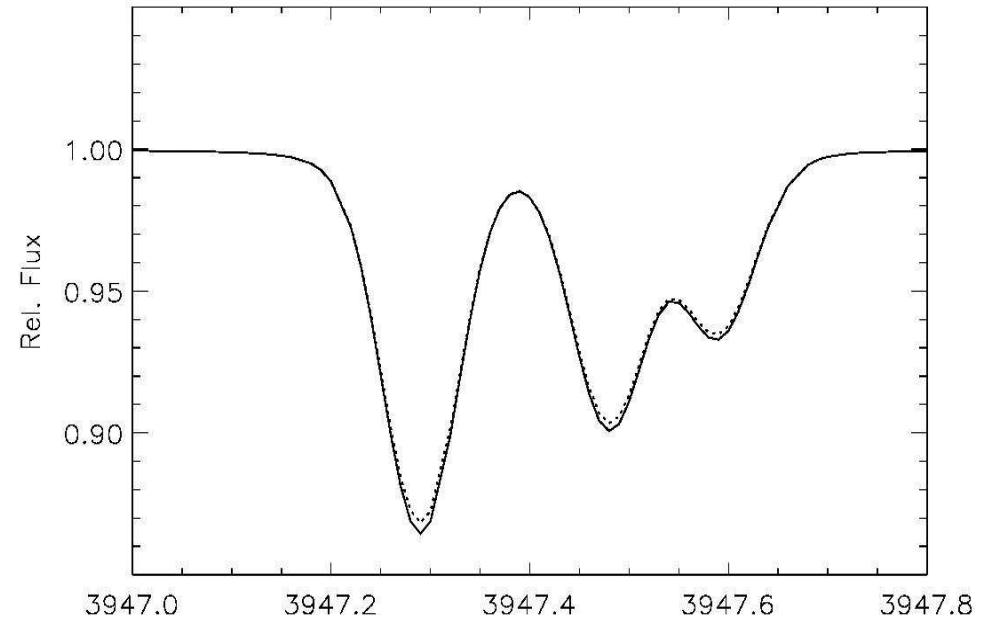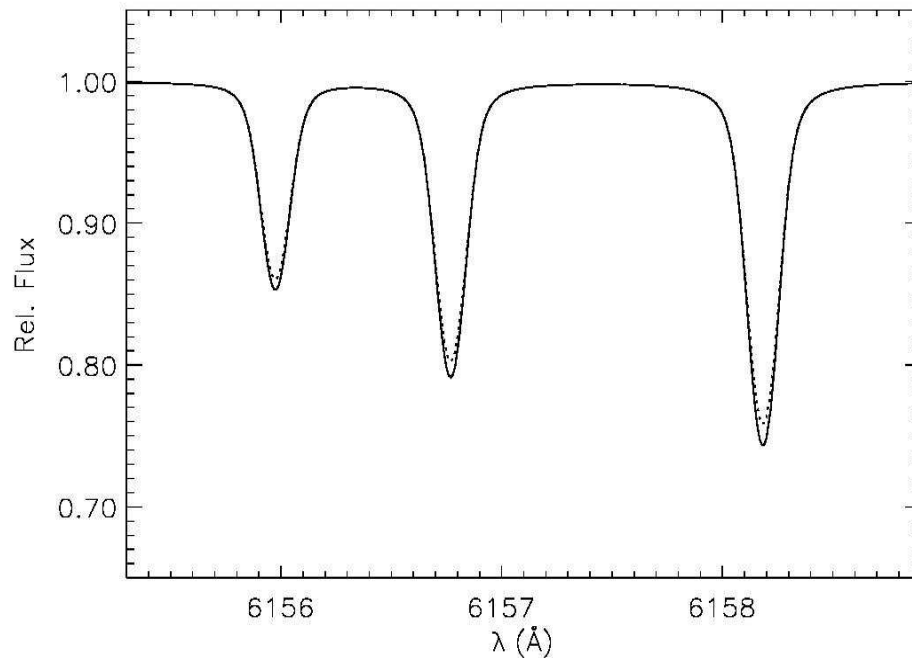**calibration with observation required**

3b) Solutions

Vega

NLTE effects can be

- large for some lines and

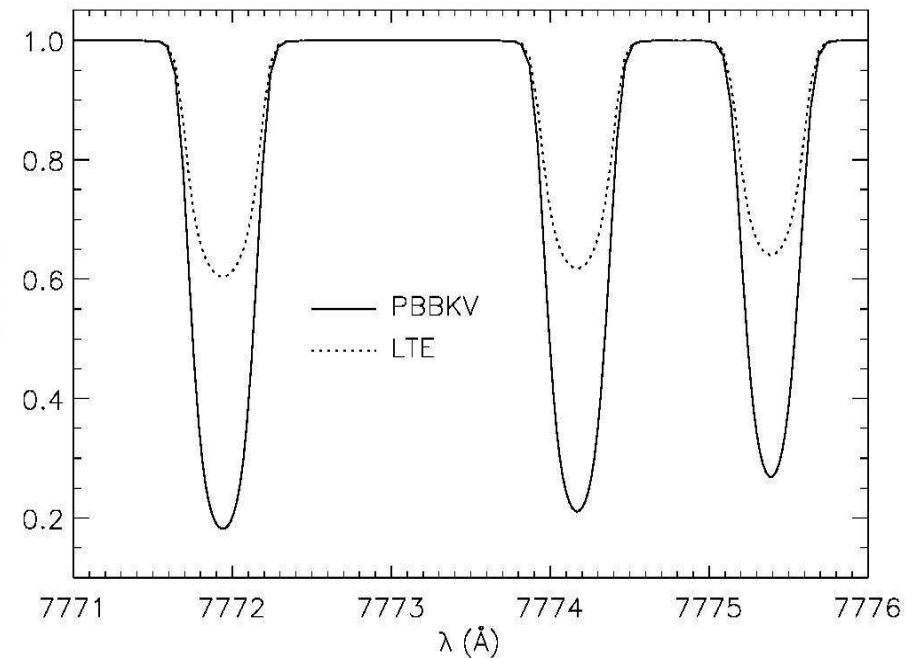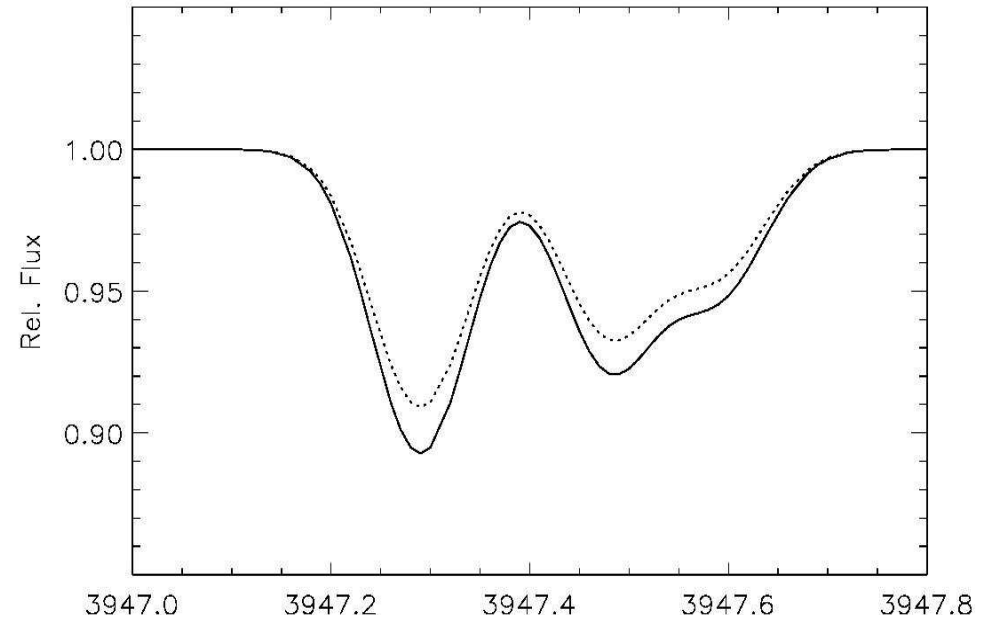- insignificant for other lines
  at one set of physical parameters ...

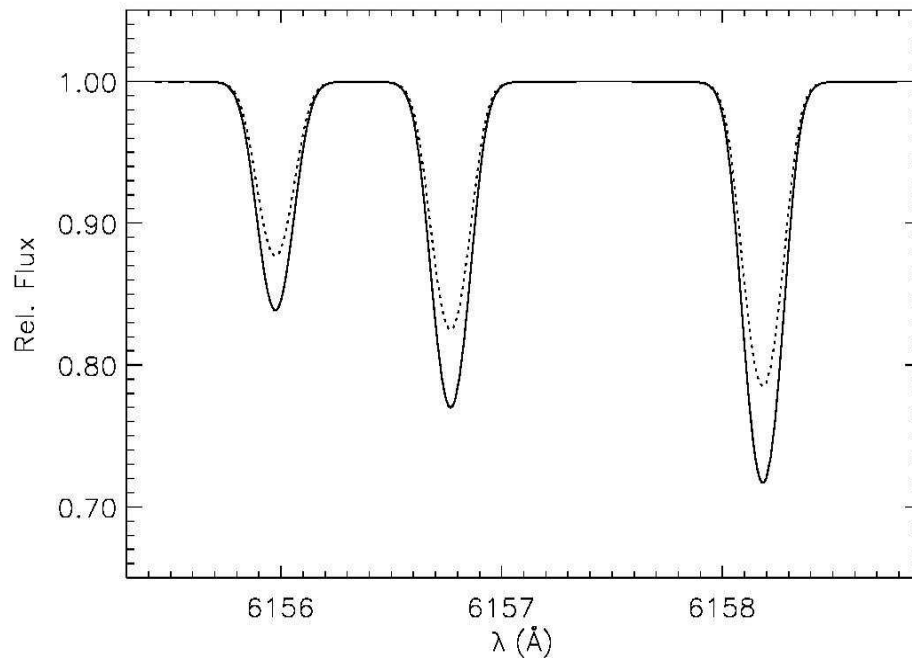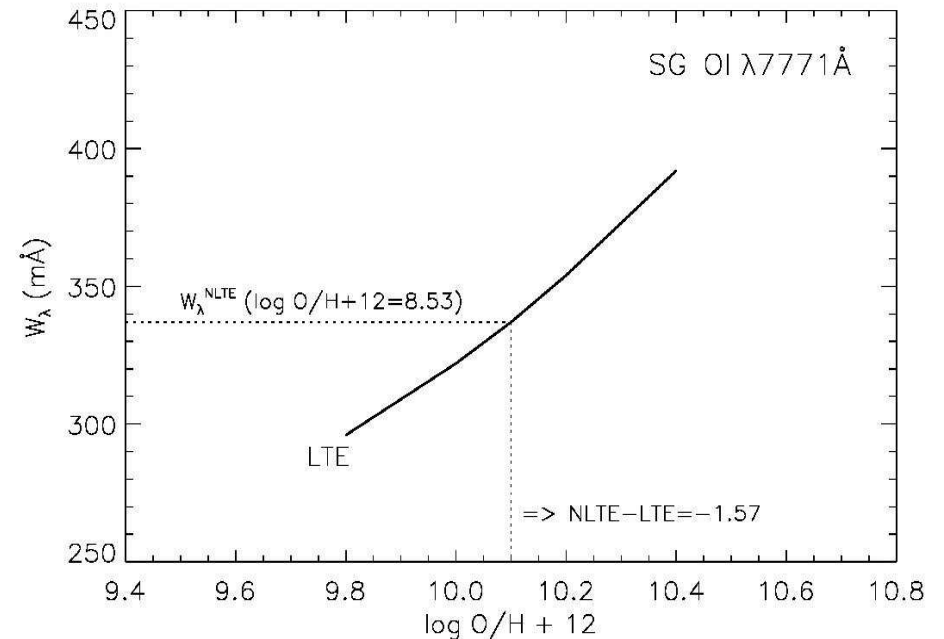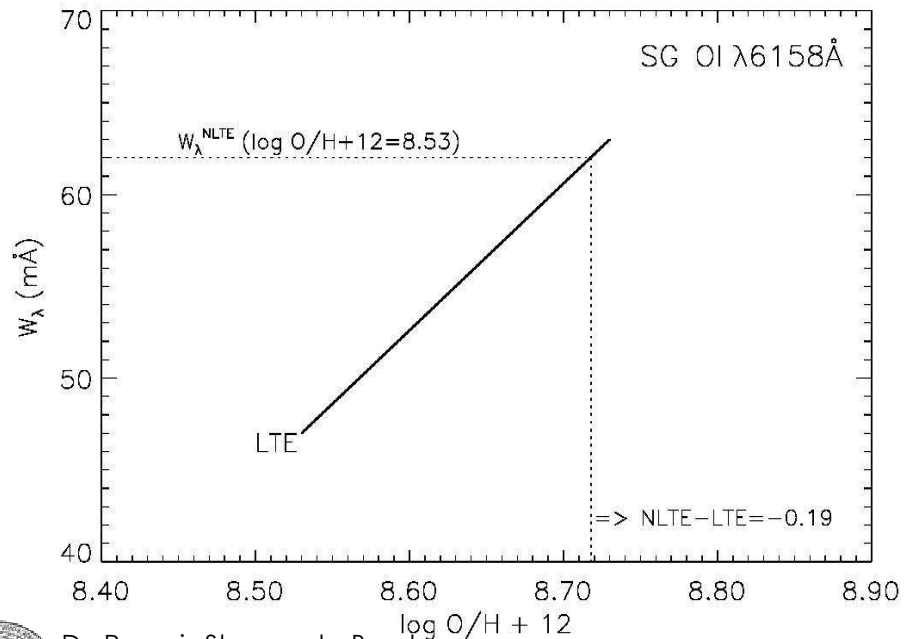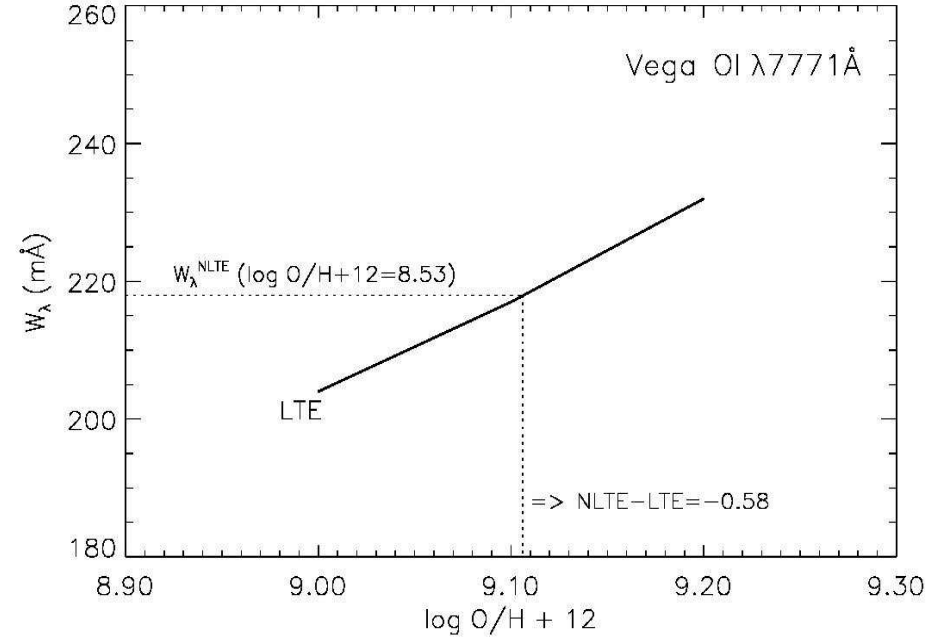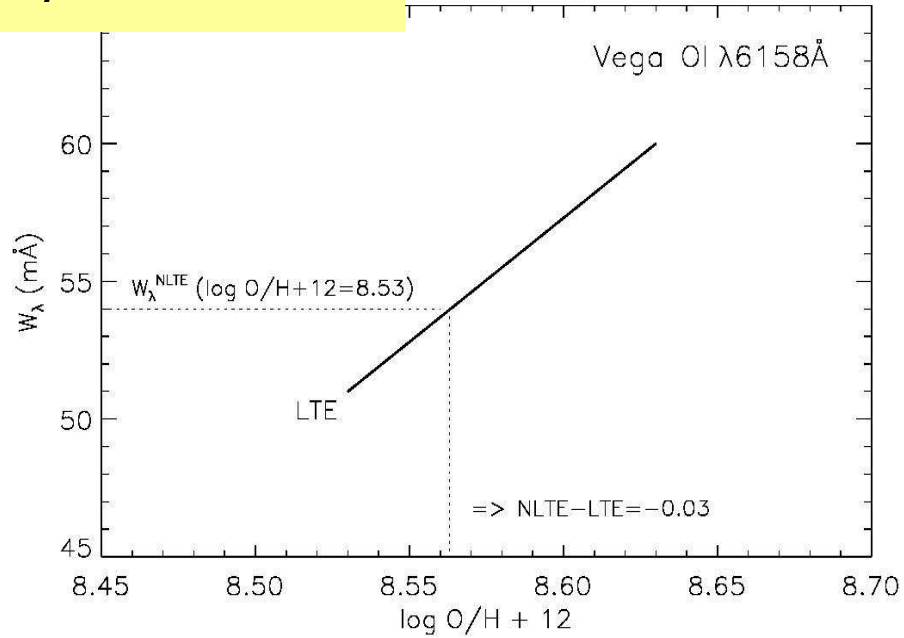# 3b) Solutions

SG

- ... but significant for all lines at another set of physical parameters

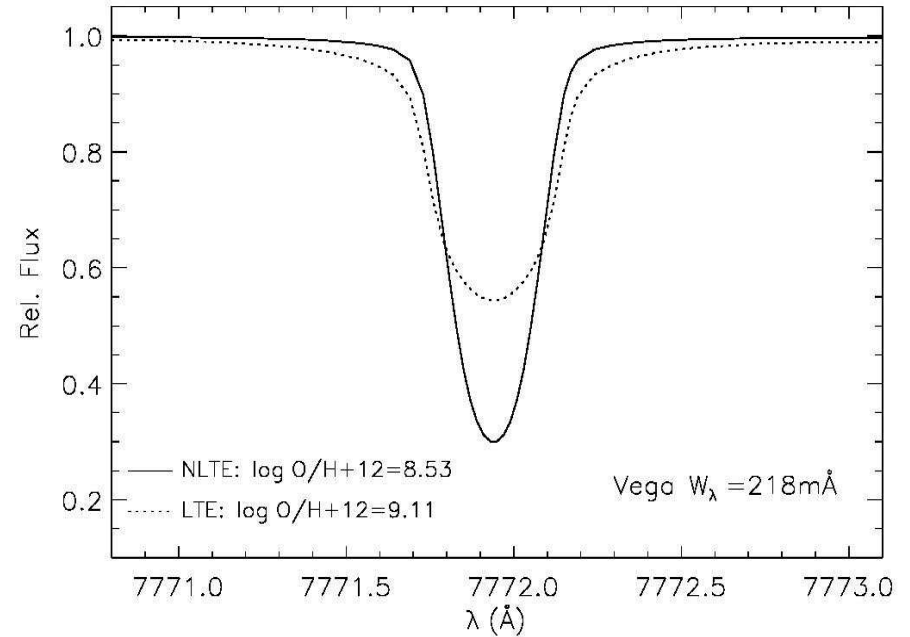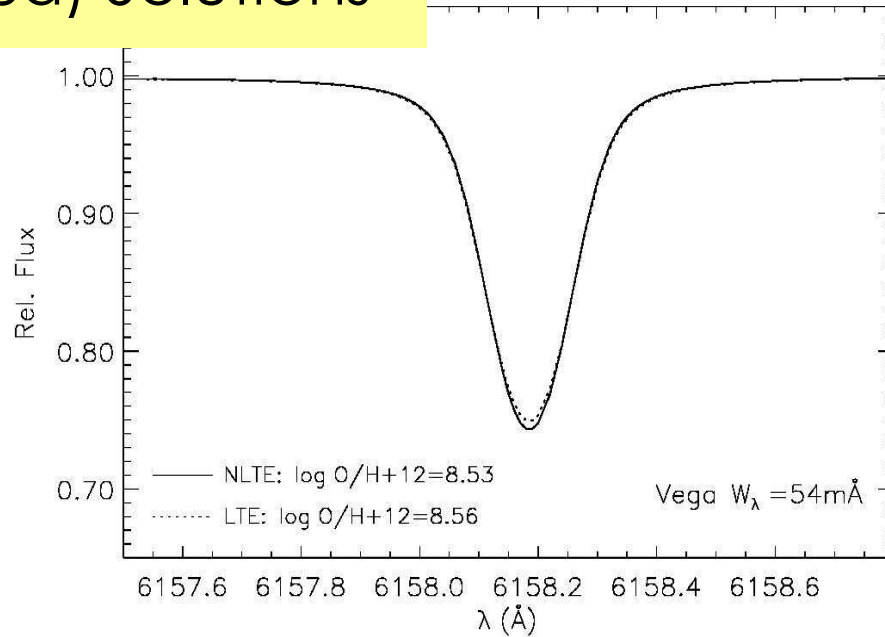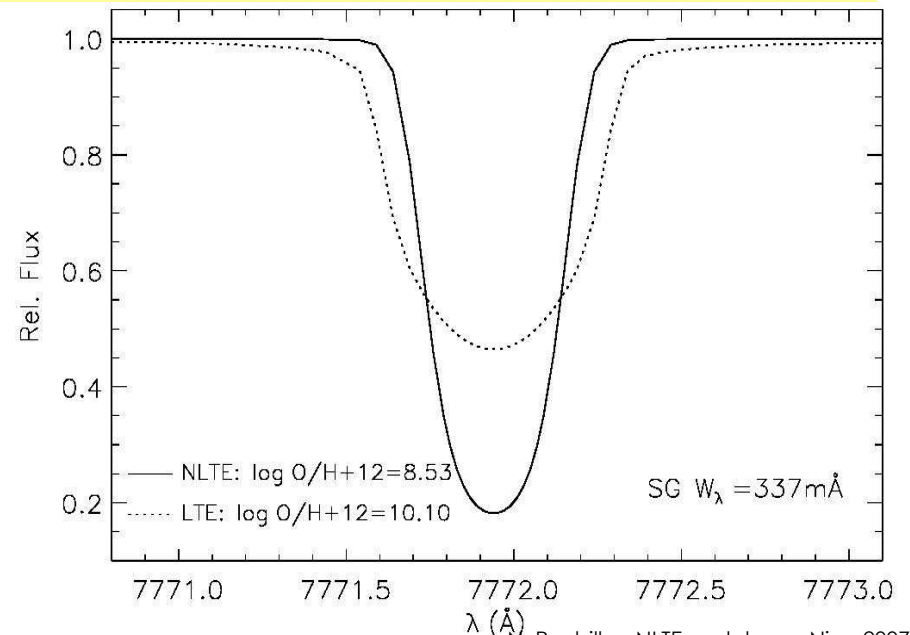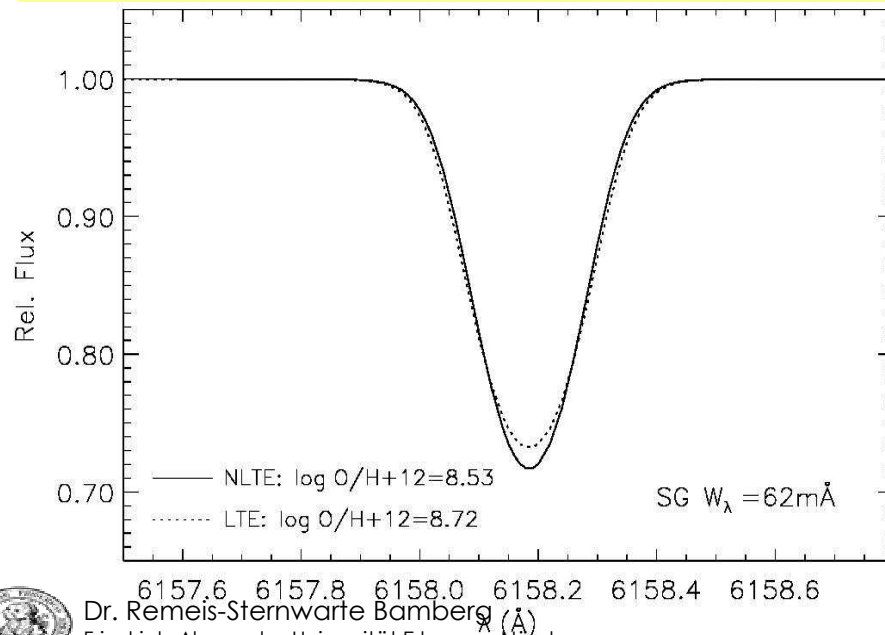**calibration with observation over wide range of physical parameters required**

3c) Solutions

3d) Solutions

nothing to 'correct': two different physical solutions - avoid W_λ, better: line profiles

3e) Solutions

- $b_i = 1$ deep in atmosphere

  ➡ inner boundary condition ok

- NLTE set in deeper in atmosphere of SG (τ_{Ross}!)

- inverse behaviour of O I & O II ground states

- large NLTE overpopulation of 3s ^{5}S°

  ➡ metastable character, endpoint of recombination cascade

- ratio of b_{lower} to b_{upper} decisive

$$S_l = \frac{2h\nu^3/c^2}{b_i/b_j \exp(h\nu/kT) - 1}$$

- line-formation depth also factor

  ➡ O I $\lambda\lambda 3947$ vs. O I $\lambda\lambda 7771\text{-}5$

Conclusions

- NLTE effects not quantitatively predictable
  - ➡ guideline: stronger lines ➡ stronger NLTE effects
    but: even weak lines may be systematically affected

- model atom construction requires guidance by
  comparison with observation
  over wide range of physical parameters

- NLTE abundance 'corrections':
  term conceptually incorrect, different physical solutions

- prefer line profile over W_λ analysis

- physics of NLTE effects can be understood (sometimes difficult!)