Robustness of the transition probability of atomic lines inferred from solar spectra

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Atomic parameters are an essential ingredient in modelling the observed spectral lines and extracting meaningful physical information about the observed astrophysical object. The atomic line parameters can be determined with different approaches from observed solar and stellar spectra. Our focus here is on the transition probability of spectral lines, usually denoted as $\log(gf)$. We use the spectropolarimetric inversion method implemented in the `globin` inversion code where atomic parameters are spatially coupled and allowed to vary in the whole field of view simultaneously (the coupled method). We use quiet-sun disc-centre observations at 1.56 μm from the GRIS/GREGOR spectrograph to test the reliability of the inferred atomic parameters. The observed spectral lines are modelled assuming local thermodynamic equilibrium. We find that the $\log(gf)$ values inferred using the coupled method from `globin` are robust against any local contamination to the observed line profiles, such as, gray stray light, and are unbiased in a chosen parametrisation of the atmospheric model and observation dataset. We determine the uncertainties in the inferred $\log(gf)$ values with the Markov chain Monte Carlo method. For the strongest lines in the analysed spectral region, the uncertainty in the $\log(gf)$ is 12 %, comparable to the uncertainties achieved in experiments. The uncertainty increases to more than 30 % for weaker and blended lines. The inferred $\log(gf)$ values differ mainly for blended lines from those reported in a recent study that uses the same observations but a different approach for the retrieval of the $\log(gf)$ values.