Utilization of the Collisional-Radiative model to analyze Doppler-free spectra

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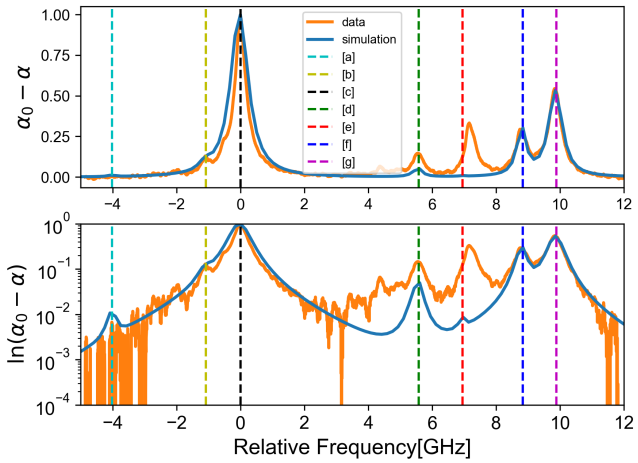
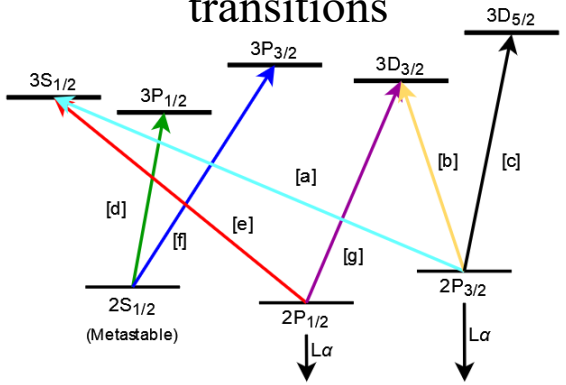
- **Lamb Dips** are created by saturated absorption spectroscopy to overcome Doppler-broadening and create Doppler-free spectra (refer to previous summary)
  - Data showcases absorption spectra of fine structure transitions involving n=2 and n=3 Hydrogen energy levels.
- **Shape and Depth** of Lamb dips shown to be dependent on experimental plasma discharge parameters
  - Suggests potential use as plasma diagnostic, but must first **model dip characteristics as functions of plasma parameters**
- **All 7 fine structure transitions replicated by model!**
- **Discrepancy between experimental and theoretical values** between 2-8 GHz range most likely due to crossover resonances not currently modeled.
- **Model predicts** changes in both width and depth of dips due to changes in laser power, electron density, as well as electron and atom temperature

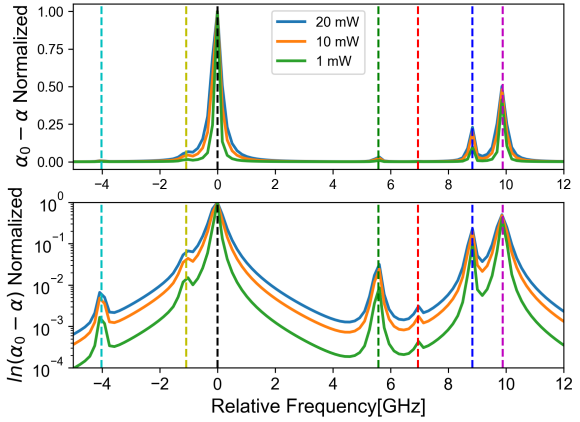
Experiment vs Simulation



Balmer-alpha fine structure transitions



Laser Power Dependence



Electron Density Dependence