Evaluation of saturated absorption condition of hydrogen Balmer-alpha line due to laser pumping

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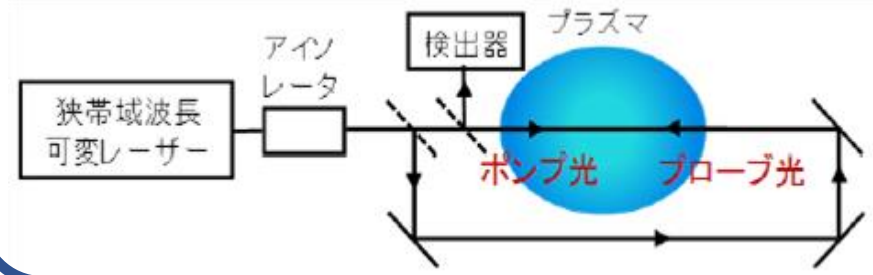
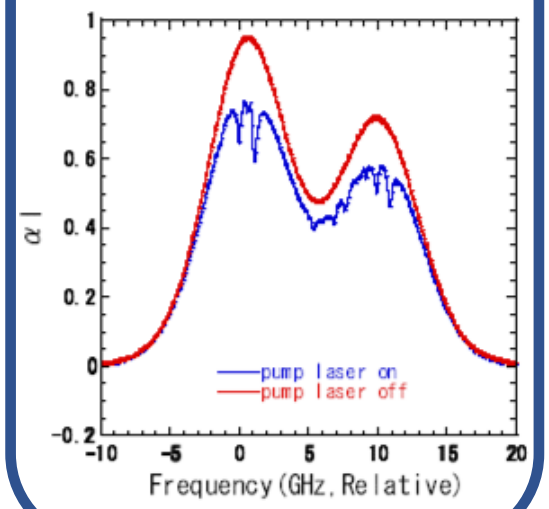
- **Saturated Absorption Spectroscopy** is an experimental technique developed to overcome the doppler broadening effect in thermally excited mediums.
  - Two-laser system where higher intensity laser pumps electrons from a single level into higher energy states, while lower intensity laser probes the remaining electrons in lower level.
  - Lasers tuned so particles only interact with both lasers at transition frequencies involving probed energy level. Absorption of the probe laser dips only at a transition frequency.
  - Data showcases absorption spectra of fine structure transitions involving n=2 and n=3 Hydrogen energy levels.
- **Collisional-Radiative Model** of Hydrogen describes particle movement between energy levels.
  - Resultant particle population densities from model used to simulate absorption conditions of each transition independently, which are then added via superposition.
- **Discrepancy between experimental and theoretical values** at transition frequencies possibly due to lower-level particle saturation via momentum transfer collisions not accounted for in CR model 'filling in' lamb dips in experimental data.

Diagram of Saturated Absorption Spectroscopy



Example of SAS data



Note

Examples shown are for illustrative purposes and are **NOT** directly comparable

Example of CR model data