Photoassociation of heteronuclear lithium

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Heteronuclear photoassociation
- various applications: high-resolution spectroscopy
- investigation of long-range interactions
- determination of scattering lengths
- production of cold molecules

Homonuclear photoassociation
- various cases: determination of internuclear distances
- collisional cooling of cold molecules
- determination of dipole-dipole interactions
- fermionic and bosonic isotope mixing

System \( ^6\text{Li}^7\text{Li} \)

Experimental setup
- detection of 39Ar, Zeeman background gas pressure of \( 3 \times 10^{-3} \) mbar
- two independent diode-laser systems
- \( ^6\text{Li}^7\text{Li} \), large-volume high-fine-structure laser system
- \( ^7\text{Li} \), large volume, high-fine-structure laser system
- cold, slow molecular beam at a mean kinetic energy of 125 kHz

Heteronuclear Spectra

Evidence
- observation of isotopes
- observation of \( ^{11} \text{Li}^6\text{Li} \), \( ^{12} \text{Li}^6\text{Li} \), \( ^{13} \text{Li}^6\text{Li} \)

Hyperfine-resolved singlet spectrum
- singlet series observed down to \( v=64 \) (3612 GHz)
- triplet series observed down to \( v=58 \) (2411 GHz)

Singlet and triplet series
- position of lines predictable with mass-scaling
- applied to homonuclear spectra

Saturation effects

Model
- photoassociation rate
- saturation in signal
- light shift and line broadening

Saturation in signal
- maximum photoassociation rate
- light shift
- linewidth

Light shift and line broadening
- light shift vs. intensity
- linewidth vs. intensity

System \( ^6\text{Li}^7\text{Li} \)

Experimental setup