

Amplification via electromagnetically induced transparency in the dressed atom basis

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Synopsis The probe transmission spectra of ^{87}Rb in an operating magneto-optical trap are experimentally studied. New gain peak and new dispersion-like structure are observed.

As one of quantum coherence effects, electromagnetically induced transparency (EIT) has been extensively studied [1]. Studies now include EIT in systems with more than three energy levels formed by more than two drive fields, an interesting topic is amplification via EIT without inversion.

Recently, Liu *et al* have studied the probe transmission spectra of ^{87}Rb in an operating magneto-optical trap (MOT) in the presence of an ionizing laser [2], they confirm that the new absorption peak and gain peak observed by Ruan *et al* [3] are composed of two components, one is from three-level Λ -type EIT in the bare atom basis, and the other one is from four-level Λ -V type EIT in the dressed atom basis.

Note that in the work of Ruan *et al* [3], the dressed atom basis are realized by the coupling light offered by the cooling/trapping laser ($5\ ^2S_{1/2}, F=2 \rightarrow 5\ ^2P_{3/2}, F'=3$) of the MOT. Here, we add an independent coupling light to the dressed atom basis for changing the population distribution of the dressed atom basis. The new gain peak and new dispersion-like structure are observed as shown in Figure 1.

Figure 2 shows the new structures around $5\ ^2S_{1/2}, F=2 \rightarrow 5\ ^2P_{3/2}, F'=2$ by adding a coupling light close to the transition of $5\ ^2S_{1/2}, F=2 \rightarrow 5\ ^2P_{3/2}, F'=2$. The more experimental and theoretical work are ongoing.

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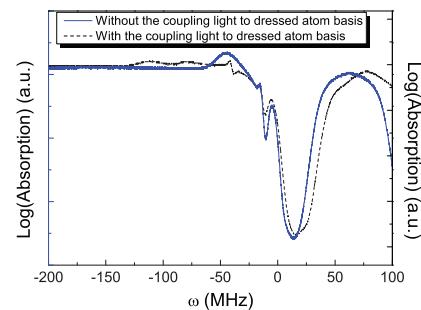


Figure 1. The probe transmission spectra of ^{87}Rb without(dash)/with(solid) the coupling light to dressed atom basis.

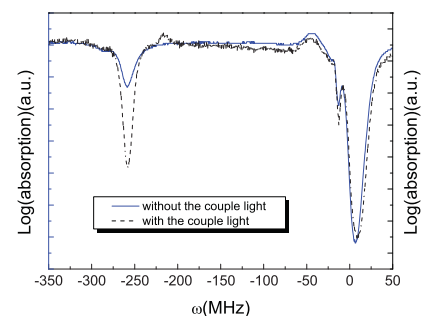


Figure 2. The probe transmission spectra of ^{87}Rb without (solid)/with (dash) the coupling light to $5\ ^2S_{1/2}, F=2 \rightarrow 5\ ^2P_{3/2}, F'=2$.

References

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