Conical emission from rubidium vapor pumped by fs laser

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An intense, near-resonant laser field can significantly modify the absorption and emission spectra of an atomic system. When a blue-detuned, intense, near-resonance laser beam propagates through the atomic vapor, a diffuse ring of light may be observed around the central laser spot in a far field. This phenomenon has been referred in the literature as conical emission (CE). CE was observed both in resonant and nonresonant media, using pulsed nanosecond [1] and cw [2] lasers. Sarkisyan et. al. reported the observation of potassium atomic vapor CE produced by 2 ps laser pulses [3]. Recently, we reported about first experimental observation of CE based on a Cs_2 molecular resonance using a femtosecond laser [4].

In the present work we report about CE in rubidium vapor induced by $\sim$ 10 nJ, 100-fs laser pulses. The CE was observed when the central laser wavelength was in the 740-840 nm interval which covers Rb D2 and D1 resonance lines. The self-focusing of the laser beam, spatial and spectral characteristics of the observed CE, cone angle dependence on the laser wavelength are described. The temporal characteristics of the laser pulses propagated through the Rb vapor is measured using intensity cross-correlation with SHG crystal. Several physical mechanisms that could lead to the CE are discussed.

References

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