On conical emission in dense sodium vapor

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Abstract

We present our work in dense sodium vapor excited by a 800 nm, 50 fs (700 μJ/pulse energy) pulse generated from a commercially available amplified femtosecond laser system with 1 kHz repetition rate. The emission pattern from the Na heatpipe is studied for the cases of a focused and unfocused input beam. The spectrum, ring structure, backward emission and other effects are presented as a function of input pulse power and atomic density. The observed spectrum is not a continuum, but narrow emission lines over a broad frequency range. Observed backward emission, along with several lines in the forward spectrum, is due to yoked superfluorescent emission. Since a femtosecond filament can form at distances up to several kilometers in the atmosphere, backward emission from the sodium layer in the mesosphere could potentially be obtained by filament excitation.

Figure 1 – Infrared pulses enter the heatpipe and leave a beautiful ring structured spectrum. Spectrum inset shows part of a sample spectrum in forward direction.