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Generation and multi-pass propagation of a squeezed vacuum field in hot Rb vapor[1] MI ZHANG, College of William and Mary, R. NICHOLAS LANNING, ZHIHAO XIAO, JONATHAN P. DOWLING, Louisiana State University, IRINA NOVIKOVA, EUGENIY E. MIKHAILOV, College of William and Mary
— We study a squeezed vacuum field generated in hot Rb vapor via the polarization self-rotation effect. By propagating the strong laser beam through a vapor cell once, we were able to achieve a noise suppression of 2 dB below shot noise. Our previous experiments showed that the amount of observed squeezing may be limited by the contamination of the squeezed vacuum output with higher-order spatial modes, also generated inside the cell. Here, we investigate whether or not the squeezing can be improved by making the light interact several times with a less dense atomic ensemble. We carry out a comparison of various conditions, e.g. injection power, atomic density, passing numbers etc., and studied their effect on squeezing level and the spatial structure of the output squeezed vacuum field. We observe that multiple passages of beam through the medium can lead to an improvement of squeezing, and minimum noise occurs at almost the same effective atomic density for all setups. We show optimization of the conditions can lead to higher achievable squeezing which would be very useful for precision metrology and quantum memory applications.

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