

Evidence for degenerate mirrorless lasing in alkali metal vapor: forward beam magneto-optical experiment

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We report an experimental observation of degenerate mirrorless lasing in forward direction under excitation of a dilute atomic Rb vapor with a single linearly polarized cw laser light resonant with cycling $F_e > F_g$ atomic D2 transitions. Light polarized orthogonally to the laser light is generated for the input light intensity exceeding a threshold value of about 3 mW/cm². Application of a transverse magnetic field directed along the input light polarization reveals a sharp about 20 mG wide magnetic resonance centered at $B = 0$. Increasing the incident light intensity from 3 to 300 mW/cm², the generated light undergoes rapid amplitude increase followed by a decline and resonance broadening. Such nonlinear behavior of the observed magnetic resonance is attributed to the population inversion on optical transitions between magnetic sublevels established under linearly polarized excitation. We present observations that indicate that a combination of nonlinear-optical effects occurs in this system, including degenerate mirrorless lasing and four-wave mixing.