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Anti-Stokes solid-state random laser[1] M. NOGINOV, G. ZHU, C. SMALL, Norfolk State University, CMR TEAM — We report on the first demonstration of anti-Stokes solid-state laser operating in the regime, when only one pumping photon is required to excite one electron to the upper laser level. The anti-Stokes stimulated emission, which photon energy was almost fifty percent larger than the energy of the pumping photon, was realized in GaAs *random laser*. Stimulated emission in random lasers is supported by feedback provided by scattering. In the experiment, highly scattering GaAs powder was pumped with ∼5 ns pulses of optical parametric oscillator tunable between 920 and 1300 nm. The random laser emission with the maximum at ≈885 nm (which corresponds to the edge of the absorption band in GaAs) has been observed when the pumping energy exceeded some critical threshold level. In some measurements, two distinctively different slopes have been found in the input-output curve. At 1100 nm pumping, the stimulated emission threshold scaled with the diameter of the excited spot d as $\sim d^x$, with $x \leq 2$. This behavior is typical to one-photon pumping of anti-Stokes GaAs random laser, while at two-photon pumping, the expected range of x is $3<x<4$. The longest pumping wavelength, at which the stimulated emission in GaAs random laser has been obtained, was equal to 1300 nm. This implies that in an ideal medium without loss the cooling effect per photon can be as high as 46%.

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