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Nonlinear dynamics of random laser generation in 3D percolating clusters

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In the artificial 3D percolation medium, the clusters filled by the nanoemitters give rise to a topologically nontrivial photonic structure with no-integer fractal dimension. In such a system, the laser model is strongly modified by the spatial percolating clusters' distribution. We systematically study a random laser emission from such advanced 3D system with radiated emitters randomly incorporated in the incipient spanning cluster. The nonlinear time dynamics and spectra of the lasing output are studied numerically. To find the optimal optical path for communications between the radiated emitters the Fermat principle was applied with the use of the quantum Monte Carlo approach.