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Geometrical structure, multifractal spectra and localized optical modes of aperiodic Vogel spirals. JACOB TREVINO, Division of Materials Science and Engineering, Boston University, SENG FATT LIEW, HESSO NOH, HUI CAO[1], Department of Applied Physics, Yale University, LUCA DAL NEGRO[2], Department of Electrical and Computer Engineering, Boston University — We present a numerical study of the structural properties, photonic density of states and bandedge modes of Vogel spiral arrays of dielectric cylinders in air. Specifically, we systematically investigate different types of Vogel spirals obtained by the modulation of the divergence angle parameter above and below the golden angle value (≈137.507 degrees). We found that these arrays exhibit large fluctuations in the distribution of neighboring particles characterized by multifractal singularity spectra and pair correlation functions that can be tuned between amorphous and random structures. We also show that the rich structural complexity of Vogel spirals results in a multifractal photonic mode density and isotropic bandedge modes with distinctive spatial localization character. Vogel spiral structures offer the opportunity to create a novel photonic devices that leverage radially localized and isotropic bandedge modes to enhance light-matter coupling, such as optical sensors, light sources, concentrators, and broadband optical couplers.

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