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High refractive index metasurfaces for programmable laser emission VAHID KARIMI, VIKTORIIA BABICHEVA, University of New Mexico — Metasurfaces of high-refractive-index materials, such as silicon or III-V compounds of gallium arsenide and similar materials, can fulfill control of light at the subwavelength scale facilitated by the excitation of Mie resonances [1]. The metasurfaces with Mie resonances have a high potential in being utilized for control of coherent light states. The integration of high-index metasurfaces and light-emitting devices, such as VCSELs and VeCSELs, has been shown as a viable technique to engineer arbitrary beam-shaping design with programmable controllability and lasering profiles. We perform numerical simulations of III-V compound metasurfaces, and we analyze the reflection, transmission, and absorption profiles of the nanostructure consisting of III-V compounds. We study different thicknesses of the intermediate layer and arrays of various periodicity, as well as nanopillar heights and radii. The metasurface's prominent scattering features originate from nanopillar Mie resonances upon illumination from either substrate or superstrate side. We demonstrate that adding the high-index intermediate layer can shift desired resonances along the spectrum. [1] V. Karimi, V. E. Babicheva, Proc. SPIE 11460, Metamaterials, Metadevices, and Metasystems 2020, 114601F (2020).

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