High-refractive-index dielectric nanoresonators and their assemblies show complex and sometimes unexpected interactions with light, including optically-induced magnetic response, directional scattering, Fano resonances, and strong near-field enhancements. Using the capabilities of modern nanotechnology, these interactions can be tuned by the size, shape, material composition, and arrangement of the nanoresonators. In addition, dielectric nanoresonators exhibit very low absorption losses at optical frequencies. Based on these unique optical properties, high-index dielectric nanoresonators represent versatile building blocks of resonant nanosurfaces with tailored linear and nonlinear optical properties. This talk will review our recent advances in light wave control with dielectric nanosurfaces using silicon nanodisks as nanoresonators. It will focus on nanosurfaces designed to impose a spatially variant phase shift onto an incident light field, thereby providing control over its wave front. Based on the simultaneous excitation of electric and magnetic dipole resonances, the nanoresonators can be tailored to emulate the behavior of the forward-propagating elementary wavelets known from Huygens’ principle. This concept allows for the realization of nanosurfaces with near-unity transmittance efficiency, full phase coverage, and a polarization insensitive response. Various examples of wavefront control will be discussed, including beam shaping and holographic imaging, both of which we have experimentally demonstrated with high efficiency at telecom frequencies.