Theory developed for the propagation of a laser beam through optical turbulence generally assumes that the turbulence is both homogeneous and isotropic and that the associated spectrum follows the classical Kolmogorov spectral power law of $-11/3$. If the atmosphere deviates from these assumptions, beam statistics such as mean intensity, correlation, and scintillation index could vary significantly from mathematical predictions. This work considers the effect of nonclassical turbulence on a propagated beam. Namely, anisotropy of the turbulence and a power law that deviates from $-11/3$. A mathematical model is developed for the scintillation index of a Gaussian beam propagated through nonclassical turbulence and theory is extended for the covariance function of intensity of a plane wave propagated through nonclassical turbulence. Multiple experiments over a concrete runway and a grass range verify the presence of turbulence which varies between isotropy and anisotropy. Data is taken throughout the day and the evolution of optical turbulence is considered. Also, irradiance fluctuation data taken in May 2018 over a concrete runway and July 2018 over a grass range indicate an additional beam shaping effect. A simplistic mathematical model was formulated which reproduced the measured behavior of contours of equal mean intensity and scintillation index.

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Approved for distribution by Ronald Phillips, Committee Chair, on September 23, 2018.

The public is welcome to attend.