

Corroboration of a multi-phase screen model

Chemist M. Mabena, Teboho Bell, and Filippus S. Roux

Abstract:

The solution of the infinitesimal propagation equation for atmospheric propagation of single-photon and entangled quantum states, represented in terms of Laguerre-Gauss modes, which is a discrete orbital angular momentum (OAM) basis, is compared with numerical simulations for the propagation of optical fields that carry OAM in atmospheric turbulence. The numerical simulations are performed using the multi-phase screen model based on the Kolmogorov theory of turbulence. The comparison was done under various turbulence conditions and propagation distances to allow comparison under both weak and strong scintillation conditions. The results show that there is an agreement between the infinitesimal propagation equation and the numerical simulations. Also, we note that in the limit of weak scintillation both methods, the infinitesimal propagation equation and numerical simulations, agree with the predictions of single-phase screen model.