Direct Numerical Simulation of Turbulence/Radiation Interactions in Nonpremixed Systems\textsuperscript{1} KSHITIJ DESHMUKH, DANIEL HAWORTH, MICHAEL MODEST, The Pennsylvania State University — An important issue in chemically reacting turbulent flows is turbulence/radiation interaction (TRI), which arises from highly nonlinear coupling between fluctuations in temperature and species composition of the flow field. Here direct numerical simulation has been employed to investigate TRI in canonical nonpremixed systems with multi-species finite-rate chemistry. Two methods have been used to solve the radiative transfer equation: a spherical harmonics (P-1) approximation and a photon Monte Carlo method. Radiation properties correspond to a nonscattering fictitious gray gas with a temperature-dependent Planck-mean absorption coefficient that mimics that of typical hydrocarbon-air combustion products. Individual contributions of emission and absorption TRI have been isolated and quantified. The temperature self-correlation, the absorption coefficient-Planck function correlation, and the absorption coefficient-intensity correlation have been examined for intermediate-to-large values of the optical thickness, and contributions from all three correlations have been found to be significant.

\textsuperscript{1}Supported by the National Science Foundation under Grant No. 0121573.