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Spectral mixing model for an inhomogeneous scalar field[1] YANG LIU, LANCE COLLINS, Cornell University — The transport equation for the composition probability density function (PDF) requires a closure approximation for the molecular mixing term. Single-point closures generally assume an Oboukov–Corrsin scalar cascade that is controlled by the integral times scale of the turbulence. In this talk, we present an alternative closure for the composition PDF derived from the eddy damped quasi normal Markovian (EDQNM) spectral theory. The PDF is described using Monte Carlo particles; however, the particles carry a spectral distribution of each scalar field. A Langevin type equation then describes scalar exchanges within the particle (cascade) and across particles (mixing). The model correctly predicts the relaxation of an initial double delta function into a near Gaussian at long times (e.g., see Eswaran and Pope; Phys. Fluids 31:506, 1987). The explicit representation of molecular mixing in the spectral closure allows the model to describe molecular effects such as differential diffusion. We recently generalized the model for the case of a spatially inhomogeneous scalar field. Results for one-dimensional diffusion of a scalar field will be shown.

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Lance Collins
Cornell University

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