Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Buoyancy–Shear–Drag–Scalar Turbulence Modeling for Rayleigh–Taylor Mixing[1] OLEG SCHILLING, Lawrence Livermore National Laboratory — A buoyancy–shear–drag model [O. Schilling, *Physica D* **402**, 132238 (2020)] is extended to include scalar variance to describe scalar (i.e., molecular) mixing in addition to mechanical mixing. The two coefficients in the scalar variance equation are calibrated to predict specific values of the scalar variance decay exponent and molecular mixing parameter for Rayleigh–Taylor mixing. An ordinary differential equation for the normalized scalar fluctuation $\Theta(t) = \phi'/\overline{\phi}$ with terms representing production and destruction of scalar variance is coupled to the buoyancy–shear–drag equations. Analytic solutions of the resulting coupled equations for Rayleigh–Taylor mixing are obtained, which modify the classical expression $h(t) = \alpha\, At\, g\, t^2$ for the mixing layer width. Applications of the buoyancy–shear–drag–scalar model to Rayleigh–Taylor turbulent mixing are briefly described.

[1]This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

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Date submitted: 02 Aug 2020 Electronic form version 1.4