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Quantitative Phase Field Simulations of Turbulent Two-Phase flows[1] NATHAN LAFFERTY, Paul Scherrer Institute, ARNOLDO BADILLO, OMAR MATAR, Imperial College London — Turbulent two-phase flows are ubiquitous and fundamental in our society. We find them in ordinary tasks such as cooking (boiling), but also in more complex systems such as internal combustion engines, power stations, and atmospheric flows just to name a few. A better understanding of the interaction between turbulent structures and interfaces, will contribute to the derivation of more accurate models, which can then be used in the optimization of current technologies or aid in the development of new ones. To assess the capabilities of the Phase-Field model in predicting turbulent two-phase flows, we simulate the dynamics of a Taylor bubble rising in a cylindrical pipe. The simulations lead to the formation of a complex turbulent pattern in the wake of the Taylor bubble, which is strongly coupled to the dynamics of the bubble skirt. We observed important changes in the turbulent structures, as we vary the level of resolution of the surface tension force. We compare our prediction of bubble rise velocity, mean velocity profiles and turbulent fluctuations with direct experimental measurements. We discuss our findings, in terms of a recently developed analytical expression for the physical error in the calculation of the surface tension force.

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