Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Passive scalar dynamics near the turbulent/nonturbulent interface in a jet RODRIGO R. TAVEIRA, CARLOS DA SILVA, IST - Technical University of Lisbon — The present work uses several direct numerical simulations (DNS) of turbulent planar jets at Reynolds number ranging from $Re_\lambda = 120$ to $Re_\lambda = 160$ and Schmidt numbers raging from $Sc = 0.7$ to 7.0 to analyze the nature and properties of the *"scalar interface"* and to investigate the dynamics of turbulent mixing of a passive scalar. Specifically, we employ conditional statistics in relation to the distance from the T/NT interface in order to eliminate the intermittency that affects common turbulence statistics close to the jet edge. The physical mechanisms behind scalar mixing near the T/NT interfaces and their associated turbulent scales and topology are investigated. A sharp scalar interface exists separating the Turbulent and the irrotational flow regions. The thickness of this scalar interface δ_θ is also of the order of the Taylor micro-scale, λ. However, the thickness of the scalar gradient variance $\langle\theta^2\rangle_I$ (where $G_j = \partial\theta/\partial x_j$) is much smaller. Very intense scalar gradient sheet structures along regions of intense strain, in particular at the T/NT interface. The scalar gradient transport equation is analyzed in order to further investigate the physical mechanism of scalar turbulent mixing at the jet edge. Almost all mixing takes place in a confined region close to the interface, beyond which they become reduced to an almost in perfect - balance between production and dissipation of scalar variance.

Carlos da Silva
IST - Technical University of Lisbon

Date submitted: 11 Aug 2011 Electronic form version 1.4