

$$\tau_w \equiv \mu \partial_y u|_w,$$

WITH DIMENSIONS
 $\mu_0 u_0 / l_0 \equiv \tau_0$

$$u_\tau \equiv \sqrt{\frac{\tau_w}{\rho}}$$

WITH u_0

$$\delta_v \equiv \frac{\nu}{u_\tau} = \frac{\mu}{\rho u_\tau}$$

WITH l_0

$$Re \equiv \frac{\rho_0 u_0 l_0}{\mu}$$

$$\partial_y = \frac{1}{l_0} \partial_y^*$$

Q: CONNECT $\tau_w^*, u_\tau^*, \delta_v^*$ WITH τ_w, u_τ, δ_v
 ACCOUNTING FOR NONDIMENSIONALIZATION

$$\tau_w^* \equiv \mu^* \partial_y^* u^*|_w$$

$$= \frac{\mu}{\mu_0} l_0 \partial_y \frac{u}{u_0} \quad \text{SUPPRESSING "/w"}$$

$$= \frac{l_0}{\mu_0 u_0} \mu \partial_y u = \frac{l_0}{\mu_0 u_0} \tau_w$$

$$A: \tau_w = \frac{\mu_0 u_0}{l_0} \tau_w^* = \tau_0 \tau_w^*$$

BUT SEE
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$$u_\tau^* \equiv \sqrt{\frac{\tau_w^*}{\rho^*}} = \sqrt{\frac{\rho_0 \tau_w}{\rho \tau_0}} = \sqrt{\frac{\rho_0}{\tau_0}} \sqrt{\frac{\tau_w}{\rho}} = \sqrt{\frac{\rho_0}{\tau_0}} u_\tau$$

$$\text{NOW } \sqrt{\frac{\rho_0}{\tau_0}} = \sqrt{\frac{\rho_0 l_0}{\mu_0 u_0}} = \sqrt{\frac{u_0^2 \rho_0 l_0}{u_0^2 \mu_0 u_0}} = \frac{1}{u_0} \sqrt{Re}$$

$$\text{SO } u_\tau^* = \frac{1}{u_0} \sqrt{Re} u_\tau \quad \text{THUS}$$

$$A: u_\tau = \frac{u_0 u_\tau^*}{\sqrt{Re}}$$

$$\delta_v^* \equiv \frac{\mu^*}{\rho^* u_\tau^*} = \frac{\mu}{\mu_0} \frac{\rho_0}{\rho} \frac{u_0}{\sqrt{Re} u_\tau} = \frac{1}{\sqrt{Re}} \frac{\rho_0 u_0 \mu}{\mu_0 \rho u_\tau}$$

$$= \frac{1}{\sqrt{Re}} \frac{\rho_0 u_0}{\mu_0} \delta_v = \frac{1}{\sqrt{Re}} \frac{\rho_0 u_0 l_0}{\mu_0 l_0} \delta_v = \frac{Re}{\sqrt{Re}} \frac{1}{l_0} \delta_v$$

$$= \frac{\sqrt{Re}}{l_0} \delta_v$$

SO

$$A: \delta_v = \frac{l_0 \delta_v^*}{\sqrt{Re}} \Rightarrow Re_\tau \equiv \frac{\delta}{\delta_v} = \frac{l_0 \delta_v^*}{l_0 \delta_v^*} \sqrt{Re} = \sqrt{Re} \frac{\delta^*}{\delta_v^*}$$

FOR CHANNEL HALF-WIDTH δ

26 NOV 2013

②

REVISITING τ_w^* UNITS,

$$\begin{aligned}
 \tau_w &= \frac{\mu_0 u_0}{l_0} \tau_w^* \\
 &= \frac{\rho_0}{\rho_0} \frac{u_0}{u_0} \frac{\mu_0 u_0}{l_0} \tau_w^* \\
 &= \rho_0 u_0^2 \frac{\mu_0}{\rho_0 u_0 l_0} \tau_w^* \\
 &= \frac{\rho_0 u_0^2}{RE} \tau_w^*
 \end{aligned}$$

WHICH IS MORE SATISFYING GIVEN U_E DEFN.
 ALSO, IT MAKES U_E VS U_E^* , S_V VS S_V^*
 RESULTS DROP OUT MORE SIMPLY.

SO, TO RECAP, USE

$$A: \tau_w = \frac{\rho_0 u_0^2}{RE} \tau_w^*$$

3-0235 — 50 SHEETS — 5 SQUARES
 3-0236 — 100 SHEETS — 5 SQUARES
 3-0237 — 200 SHEETS — 5 SQUARES
 3-0137 — 200 SHEETS — FILLER

COMET