

Abstract Submitted  
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**Passive scalars in turbulent channel flow at high Reynolds number**<sup>1</sup> SERGIO PIROZZOLI, MATTEO BERNARDINI, PAOLO ORLANDI, Sapienza Università di Roma, Dipartimento di Ingegneria Meccanica e Aerospaziale — We study passive scalars in turbulent plane channels at computationally high Reynolds number, which allows to observe previously unnoticed effects. The mean scalar profiles are found to obey a generalized logarithmic law which includes a linear correction term in the whole lower half-channel, and they follow a universal parabolic defect profile in the core region. This is consistent with recent findings regarding the mean velocity profiles in channel flow. The scalar variances also exhibit a near universal parabolic distribution in the core flow, and hints of a sizeable log layer, unlike the velocity variances. The energy spectra highlight the formation of large scalar-bearing eddies spanning each half-channel, which are caused by production excess over dissipation, and which are clearly visible in the flow visualizations. Close correspondence of the velocity and scalar eddies is observed, the main difference being that the latter have more convoluted interfaces, which translates into higher scalar dissipation. Another notable Reynolds number effect is the decreased correlation of the scalar field with the vertical velocity field, which is traced to the reduced effectiveness of ejection events.

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