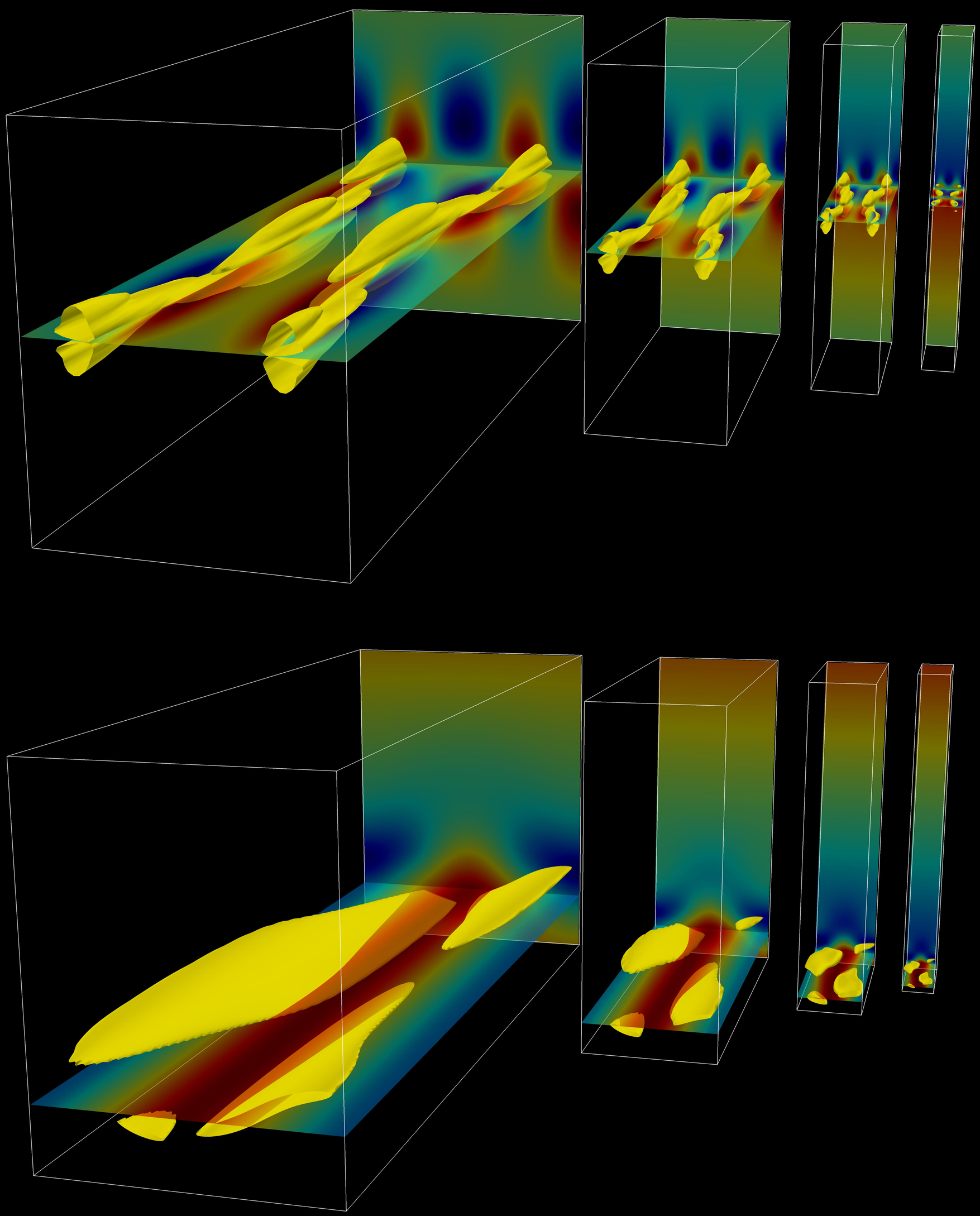
Exact coherent states as building blocks for the turbulent cascade

Stefan Zammert and Bruno Eckhardt

Turbulence at high Reynolds numbers covers many scales. Energy is extracted from the mean flow at large scales and transported along the turbulent cascade to smaller scales where dissipation takes over. The images below show a set of exact coherent states in plane Couette flow at Re=100.000 that covers all scales, from the width of the domain on the left to the Kolmogorov scale on the right. The states in the top row are concentrated in the middle between the plates, the ones in the bottom row near a wall.

The visualizations use iso-surfaces of the Q-vortex criterion with an iso-value increasing by factors of four from left to right. In the mid and back plane the streamwise velocity component is color-coded.



These structures provide the building blocks for a description of the turbulent cascade and boundary layers in terms of exact coherent structures.

Philipps-Universität Marburg, Germany
Delft University of Technology, The Netherlands