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A Spectral Clustering Approach to Lagrangian Vortex Detection ALIREZA HADJIGHASEM, DANIEL KARRASCH, ETH - Zurich, HIROSHI TERAMOTO, Hokkaido University, GEORGE HALLER, ETH - Zurich — One of the ubiquitous features of real-life turbulent flows is the existence and persistence of coherent vortices. Here we show that such coherent vortices can be extracted as clusters of Lagrangian trajectories. We carry out the clustering on a weighted graph, with the weights measuring pairwise distances of fluid trajectories in the extended phase space of positions and time. We then extract coherent vortices from the graph using tools from spectral graph theory. Our method locates all coherent vortices in the flow simultaneously, thereby showing high potential for automated vortex tracking. We illustrate the performance of this technique by identifying coherent Lagrangian vortices in several two- and three-dimensional flows.

Alireza Hadjighasem
ETH - Zurich

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