Determining the direction of a turbulent cascade\textsuperscript{1} WALTER GOLDBURG, University of Pittsburgh, RORY CERBUS, Okinawa Institute of Science and Technology — In two-dimensional (2D) turbulence, one expects a cascade of energy to larger spatial scales, while the enstrophy cascade is to smaller ones. Here we present a new tool to study cascades using simple ideas borrowed from information theory. It is entirely unrelated to the Navier-Stoke’s equations or any scaling arguments. We use the conditional entropy (conditioned uncertainty) of velocity fluctuations on one scale conditioned on another larger or smaller scale. If the entropy is larger after conditioning on larger scales rather than smaller ones, then the cascade is to smaller scales. By varying the scale of the velocity fluctuations used in the conditioning, we can test both direction and locality. We use these tools on experimental data taken from a flowing soap film, an approximately 2D turbulent flow. The Reynolds number is varied over a wide range to determine the entropy’s scaling with Reynolds number

\textsuperscript{1}OIST

Rory Cerbus
Okinawa Institute of Science and Technology

Date submitted: 30 Jul 2015
Electronic form version 1.4