Stories of Vortices That Do Not Fly Away

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This talk will present the stories of two very special vortices. The first one is the separated vortex ring of the dandelion fruit. This vortex levitates stably above the dandelion, which uses the vortex as a parachute to decrease its sinking velocity and to maximise dispersal. This formidable aerodynamic feature enables the dandelion fruit to be transported by the wind for more than hundred kilometres before settling down in our gardens.
The second one is the leading-edge vortex of asymmetric spinnakers, which are the largest and most powerful sails used by America's Cup yachts. These sails have a very small thickness, which makes them more similar to the wings of small birds and insects than conventional aeronautical wings. It will be shown that the boundary layer of these sails is made of large leading-edge vortices that roll along the sail. When one of these vortices finds an equilibrium position near the leading edge, the sail gains additional thrust.
It will be shown that these two vortices have a key common feature, which is rare between vortices: they remain stably near the body that formed them, without convecting downstream with the flow. As a result, both these vortices enable exceptional aerodynamic performances.

Dr Ignazio Maria Viola is Senior Lecturer at the Institute for Energy Systems of the School of Engineering, University of Edinburgh. His research is in applied fluid dynamics and focuses on the vortices formed by sails, wings and blades in turbulent flow. His background is in yacht engineering, a field where he has worked for more than 15 years and has collaborated with 4 America's Cup teams and 1 Olympic team. Since appointed Lecturer at the University of Edinburgh in 2013, he has established a research group of 12 postgraduate researchers (www.homepages.ed.ac.uk/iviola) and has extended his work to biomechanics and tidal energy. His recent work on the leading-edge vortex of swift wings featured on the national media. He was awarded 2 Medals of Distinction (2015, 2012) and 1 Medal of Exceptional Merit (2011) by the Royal Institution of Naval Architects, an institution of which he was elected Fellow. He is the Editor-in-Chief of the Journal of Sailing Technology. His research is funded by EPSRC, EU, Leverhulme Trust, Carnegie Trust, Energy Technology Partnership and Industry.

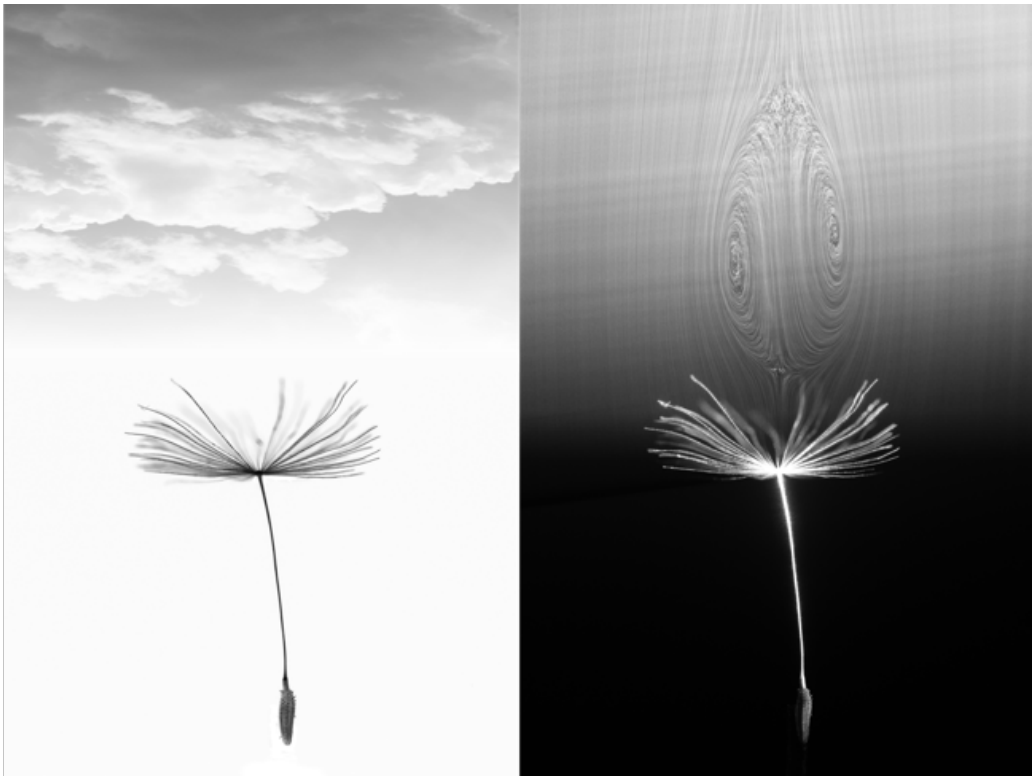

Figure 1: The halo' vortex ring that lifts the dandelion seeds