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Thumbs up! Bird's thumb induces leading-edge vortex during slow gliding flight[1] THOMAS LINEHAN, KAMRAN MOHSENI, University of Florida — The alula, or bird's thumb, consists of a small set of feathers stationed near the bird's wrist that protract from the wing during slow flight to enhance lift. The recent discovery of leading-edge vortices (LEVs) on the thin hand-wings of some birds suggest that the alula may play a role in LEV formation. Using stereoscopic-digital particle image velocimetry we measured the flow over a model wing with and without protracted alulae in a wind tunnel and made volumetric reconstructions of the three-dimensional vortex flow. We found that the alula induces and stabilizes a robust conical leading-edge vortex (LEV) that sweeps across the outer wing and smoothly merges with the tip vortex. LEV formation is the result of the alula scraping spanwise vorticity from the leading-edge shear layer and inducing its roll-up. The subsequent stabilization of the LEV is the result of root-to-tip spanwise flow in the LEV core of magnitude greater than 80% of the freestream value. In essence, the protracted alula, mimicking a canted flap, is a clever way of inducing and stabilizing a LEV on a steadily translating wing inclined to the flow at high angles. These results grant new insights into the intelligent design of the modern bird wing and has important implications for aircraft flight control.

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