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On the mechanism that sustains intermittent attached cavitation inception in a boundary layer without flow separation.[1] OMRI RAM, KARUNA AGRAWAL, JOSEPH KATZ, Johns Hopkins University — Attached cavitation inception on a curved body typically occurs when the minimum pressure is reduced below the vapor pressure. There is only limited qualitative understanding of the mechanisms involved with the attachment of free stream nuclei to the surface, and it is not clear how the inception is sustained intermittently once it starts. Water tunnel experiments involving high-speed microscopic imaging focus on these processes for a flow with an attached boundary layer downstream of the minimum point. Once a freestream nucleus grows and attaches to the surface, it collapses in milliseconds, leaving a cloud of microbubbles small than 30 μm downstream of the minimum pressure point. Some of these bubbles migrate randomly near the surface, as confirmed by statistical analysis, presumably under the balancing influence of drag that pushes them downstream and local adverse pressure gradient that pulls them upstream. Hence, the bubbles are maintained near the surface, even without flow separation. Of those that migrate upstream, a fraction grows to form another intermittent cavity that generates new microbubbles. Hence, once the initial attachment occurs, subsequent attached cavities appear at a frequency that is much higher than that associated with the freestream nuclei.

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