Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Path stability of a rising bubble[1] BINZE YANG, ANDREA PROSPERETTI, Johns Hopkins University — A millimeter-size gas bubble rises in a zigzag or spiral path in still water. A linear analysis of this process is presented assuming that the bubble has a fixed ellipsoidal shape of varying aspect ratio. The results exhibit a strong similarity to the stability features of the flow past a solid sphere. By focusing on the $m = 1$ azimuthal mode, it is found that a double-threaded wake responsible for the deviation from the vertical path develops when the aspect ratio is sufficiently large. The stability analysis of "frozen" states before steady conditions are achieved shows that the amount of vorticity accumulated at the rear of the bubble plays an essential role for the instability. It is also shown that, in the common parameter ranges of interest, the instability is very sensitive to the deformation of the bubble, but relatively insensitive to the Reynolds number.

[1]Supported by NASA

Andrea Prosperetti
Johns Hopkins University

Date submitted: 17 Nov 2005 Electronic form version 1.4