

Abstract for an Invited Paper
for the MAR10 Meeting of
The American Physical Society

The Flight of a Baseball

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The trajectory of a baseball moving through the air is very different from the one we teach in our introductory classes in which the only force is that due to gravity. In reality, the aerodynamic drag force (which retards the motion) and the Magnus force on a spinning baseball (which causes the ball to curve) play very important roles that are crucial to many of the subtleties of the game. These forces are governed by three phenomenological quantities: the coefficients of drag, lift, and moment, the latter determining the spin decay time constant. In past years, these quantities were studied mainly in wind tunnel experiments, whereby the forces on the baseball are measured directly. More recently, new tools have been developed that focus on measuring accurate baseball trajectories, from which the forces can be inferred. These tools include high-speed motion analysis, video tracking (the so-called PITCHf/x and HITf/x systems), and Doppler radar tracking via the TrackMan system. In this talk, I will discuss how these new tools work, what they are teaching us about baseball aerodynamics, and how they have the potential to revolutionize the analysis of the game itself.