Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Spray From a Rolling Tire: Mechanics of Droplet Formation[1]
DENNIS PLOCHER, FRED BROWAND, Aerospace & Mechanical Engineering Dept., University of Southern California — The spray pattern immediately behind a single-groove tire rolling on a wet surface is produced in the laboratory using a specially designed tire spray simulator. The spray development is examined using high speed video. Water from the groove forms a liquid sheet as the tire-tread lifts away from the surface. The sheet is not of uniform thickness, but it remains attached to the tread. The thinner portions of the sheet become even thinner as the tire rotates, and eventually break to produce holes near the tire surface. The holes grow as the sheet margins surrounding the holes retract into the thicker portions of the sheet which become roughly cylindrical "ligaments" aligned at right angles to the direction of spray motion. The ligaments break into large droplets *via* a Rayleigh instability. The smallest droplets form when the margins of two holes collide. As Weber number, $We = \rho U^2 w/2\sigma$, based on tire groove half width, w/2, varies by a factor of 25, the sheet-ligament structure persists, but ligaments become less organized, and more small droplets appear in the pattern.

[1]Supported in part by U.S. Dept. of Energy and Michelin Americas Research & Development Corp.

Dennis Plocher
University of Southern California

Date submitted: 04 Aug 2010 Electronic form version 1.4