Ingredients involved in splashing revealed

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"Splashing" plays a central role in the transport of pollutants and the spread of diseases, but while the sight of a droplet striking and splashing off of a solid surface is a common experience, the actual physical ingredients and mechanisms involved in splashing aren't all that well understood.

A team of Brown University and Harvard University researchers has discovered that there is indeed more involved in splashing than previously believed. They will discuss their findings at the upcoming American Physical Society's 64th Annual Division of Fluid Dynamics Meeting, which will be held Nov. 20-22, 2011, in Baltimore, Maryland.

"In recent studies, it was highlighted that the surrounding air plays an important role in the splashing process. Decreasing the ambient pressure inhibits splashing," explains Julie Albagnac, a postdoctoral research associate in engineering at Brown. "The observations led to a hypothesis of the existence of a thin layer of air trapped between the drop and the surface."

To better understand droplet splashing, the researchers initially wanted to observe and measure this layer of trapped air. They hypothesized that splashing may occur even before actual contact of the drop on the surface, while the drop is still spreading on an air film.

Unfortunately, they found that experimental equipment available today isn't sophisticated enough to catch a length as small as the air layer thickness (hundreds of nanometers) during the short time of existence of

this air layer (hundreds of nanoseconds). So they instead studied the time evolution and behavior of droplets splashing with various impact velocities under a variety of ambient pressures to examine different scenarios involving splashing.

For this purpose, experiments performed at Harvard provide side and bottom views of the droplets. "This study shows a new signature of a precursor to the splashing through the wriggling of the contact line at the interface between the droplet and the surface," says Albagnac.

The splashing/spreading of a droplet doesn't seem to be an on/off situation, according to the team. A transition regime exists between the spreading and splashing, which they observed by changing either the impact velocity or the ambient pressure while the other is fixed.

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