

Wine 'legs' are made by a shock wave in a wineglass

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Body

THE drops that run down the inside of a glass after **wine** is swirled – called "legs" or "**tears**" – are caused by a shock wave interrupting the ring of fluid that sticks to the glass.

We know that a film of **wine** can flow up the side of a glass after swirling because the water in **wine** evaporates faster than the alcohol, creating a difference in surface tension that drives liquid upward. But exactly what caused **wine tears** to form was a mystery until now.

Hangjie Ji at the University of California, Los Angeles, and her colleagues have built a model that considered the effects of gravity, the shape of the glass, the **wine's** alcohol concentration and the motion of swirling. The model suggests that the contrast between the flow of liquid up the side of the glass – due to surface tension differences – and the downward pull of gravity could lead to the formation of a shock wave.

They tested the idea by swirling **wine** in glasses in the lab, and saw what is called an undercompressive shock wave forming as a ridge in the liquid climbing the side of the glass (*Physical Review Fluids*, doi.org/dqn5).

This type of shock wave is unstable, which is why it causes the formation of thick drops that eventually fall down as **tears**, rather than as a continuous flow of liquid.

"**Wine tears** have been studied for over a century and it is remarkable that this is the first time that they have been connected to the instability of an undercompressive shock," says Anette Hosoi at the Massachusetts Institute of Technology. "This study is a beautiful example of such shocks in a familiar setting," she says.

Ji says the formation of liquid films driven by wind, such as on car windscreens or aeroplane wings, could also be explained by these unstable shock waves.

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