GARAGE SERIES

PRESENTS

# WATER DROP PHOTOGRAPHY

# Fluid Dynamics

# FLUID DYNAMICS

## Basic Fluid Principles

The fluid concepts that apply in fluid statics also come into play when studying fluid that is in motion. Pretty much the earliest concept in fluid mechanics is that of buoyancy, discovered in ancient Greece by Archimedes.

As fluids flow, the density and pressure of the fluids are also crucial to understanding how they will interact. The viscosity determines how resistant the liquid is to change, so is also essential in studying the movement of the liquid. Here are some of the variables that come up in these analyses:

Bulk viscosity: $\mu$
Density: $\rho$
Kinematic viscosity: $\nu = \mu / \rho$

## Bernoulli's Principle

*Bernoulli's principle* is another key element of fluid dynamics, published in Daniel Bernoulli's 1738 Simply put, it relates the increase of speed in a liquid to a decrease in pressure or potential energy. For incompressible fluids, this can be described using what is known as *Bernoulli's equation*:

Where $g$ is the acceleration due to gravity, $\rho$ is the pressure throughout the liquid, $v$ is the fluid flow speed at a given point, $z$ is the elevation at that point, and $p$ is the pressure at that point. Because this is constant within a fluid, this means that these equations can relate any two points, 1 and 2, with the following equation:

The relationship between pressure and potential energy of a liquid based on elevation is also related through Pascal's Law.

## ***Fluid Dynamic or Shear Viscosity Formula***

$$\mu = \frac{Fy}{Au}$$

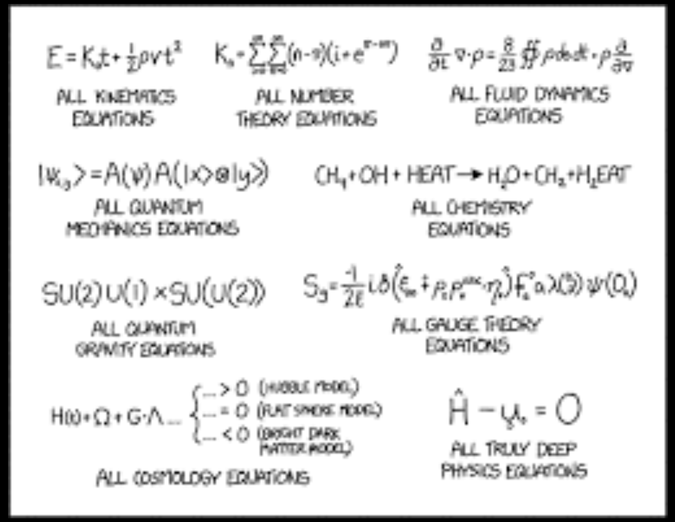
$\mu$ – *dynamic viscosity in* $N\ sec/m^2$

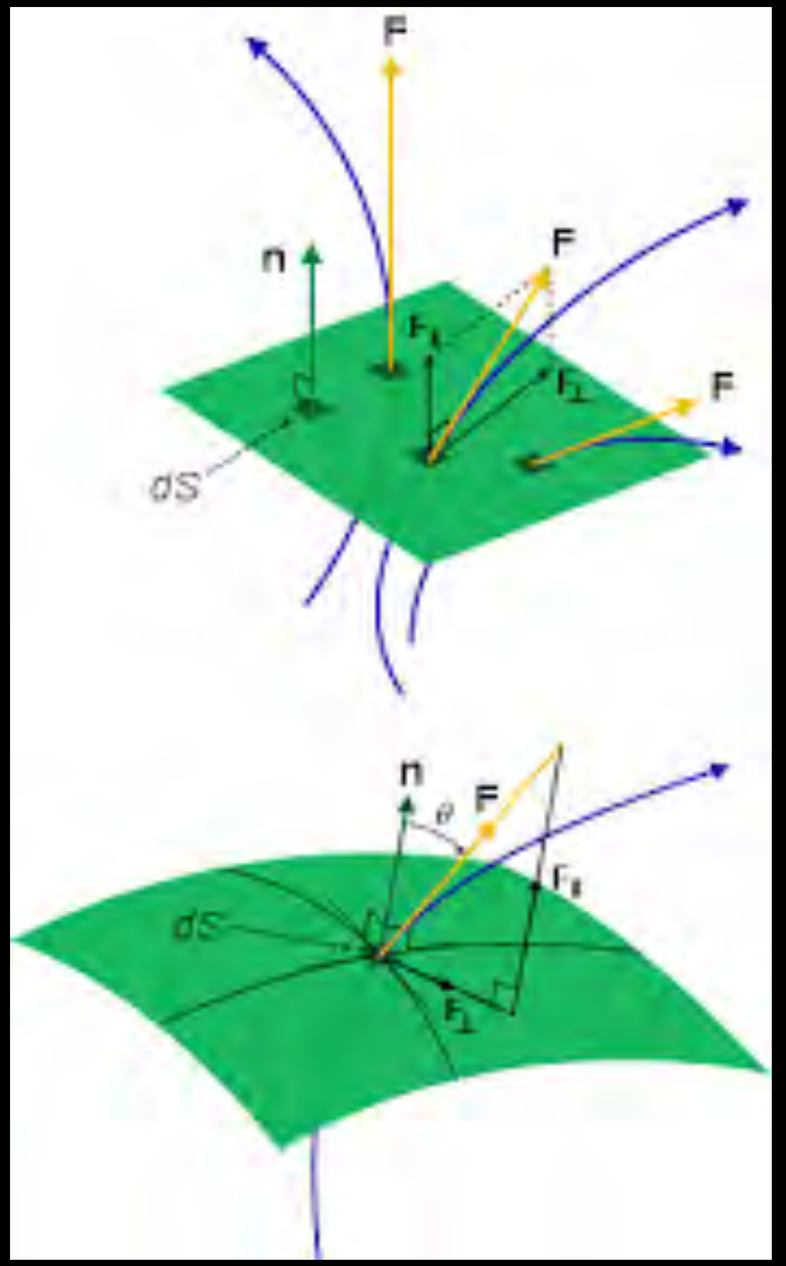
$F$ – *applied force in* $N$

$y$ – *separation distance in* $m$

$A$ – *area of each plate in* $m^2$

$u$ – *speed in* $m/s$



# AGENDA: Water Drop Collisions

| | |
|---|---|
| Equipment: | What's needed? |
| Basic Set-up | How do I do this? |
| Settings | Where to start? |
| Calibration | The hard part! |
| Photoshop | Only minor Adjustments |
| Images | Creativity |
| Questions | There will be a pop quiz! |

# Equipment: What do I need?

Solenoid Valve and Siphon (by Pluto)

Trigger (by Pluto)

Pluto Control App.

Shutter Release Cable (for camera manuf.)

Light Stand with Clamp

Two or Three Speedlite's

Camera with Transmitter to fire speedlite's

100mm Macro Lens
Water dish (square for better background horizon

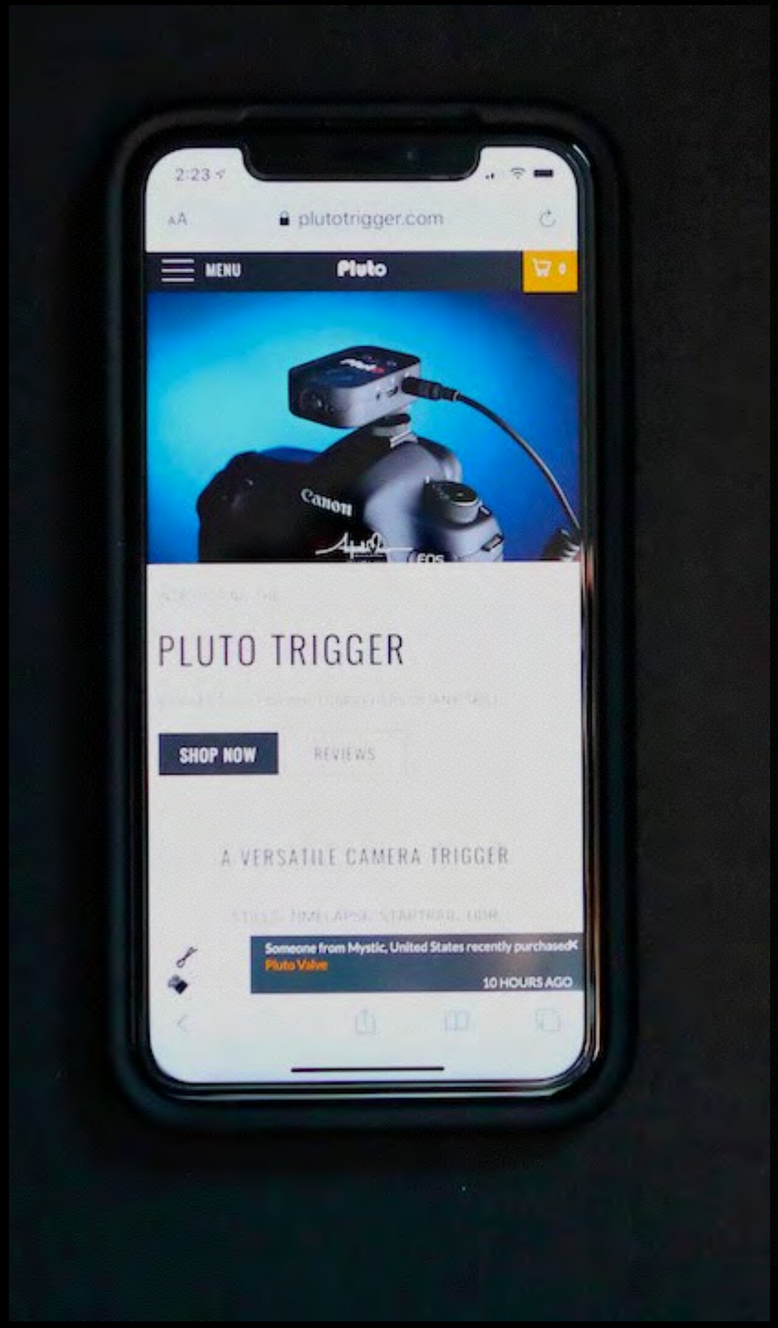
Liquids:

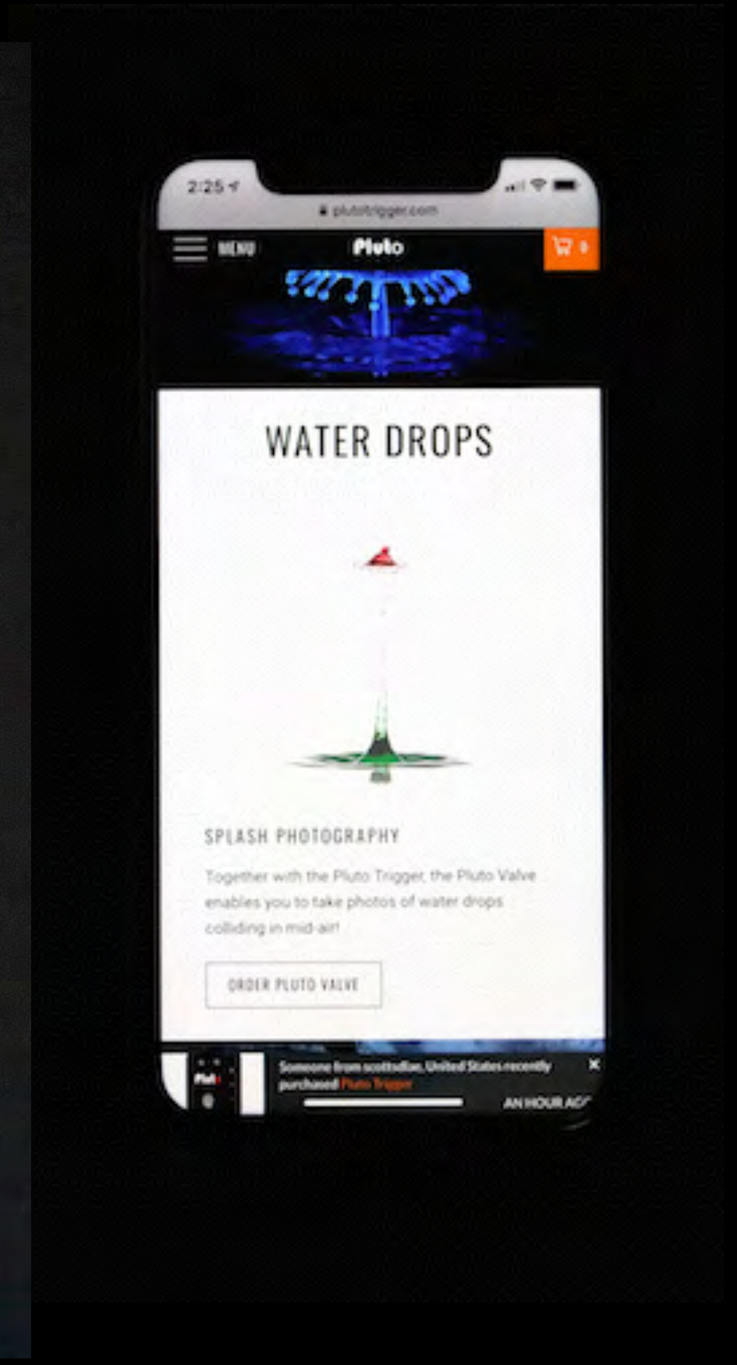
Water, food coloring, milk, glycerin…… TEQUILA ?

**…..and NO I have not tried lighter fluid**

# Optional  Drop System

Photix
FOOD COLORING




# PLUTO TRIGGER

Shutter Release

Timelapse

HDR

Startrail

Timer

Laser

Sound

Light

Lighting

Infrared

Droplet

Sound

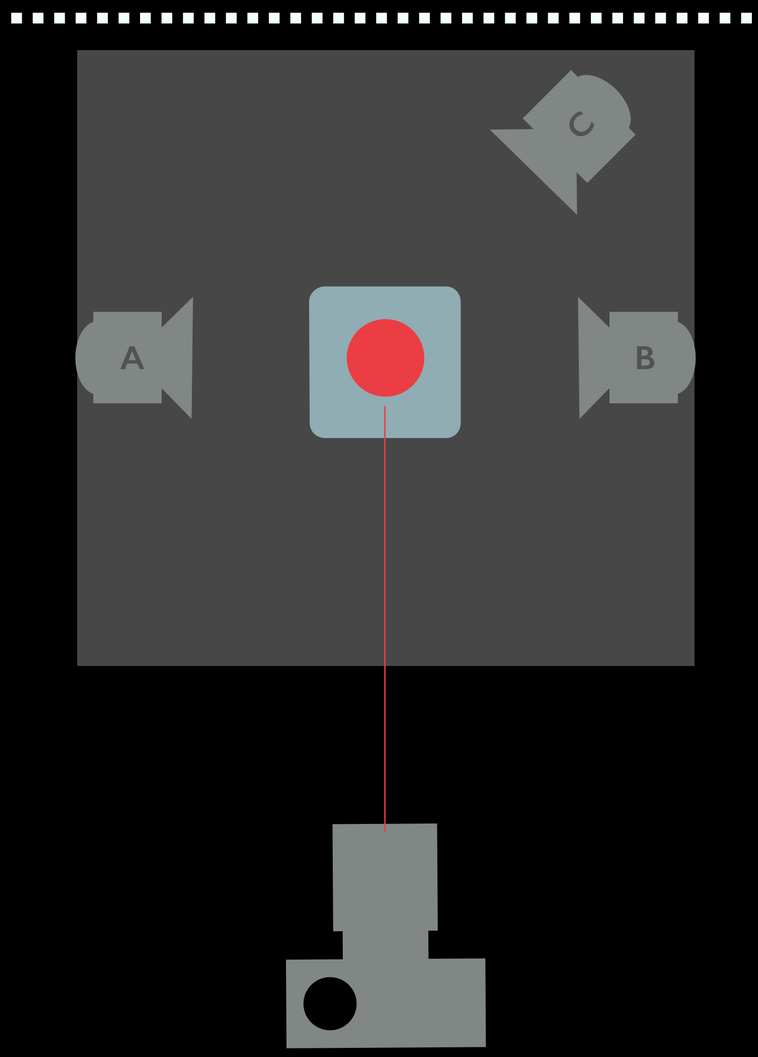
Motion

# Basic Setup  How do I do this?

Position camera with 100mm macro approximately 18 to 24 inches away from center of drop zone

Use  at least two speedlites with diffuser and snoot for control of light.  Experiment with their positions and colored gels for different effects.  Play with a third speedlite. Top Lighting

Use a clear glass square bowl on Black Base
I use a black background to contrast the drop collision. Try different color background to play off different color water.



# Basic Setup: Vertical Position

The camera height is important!

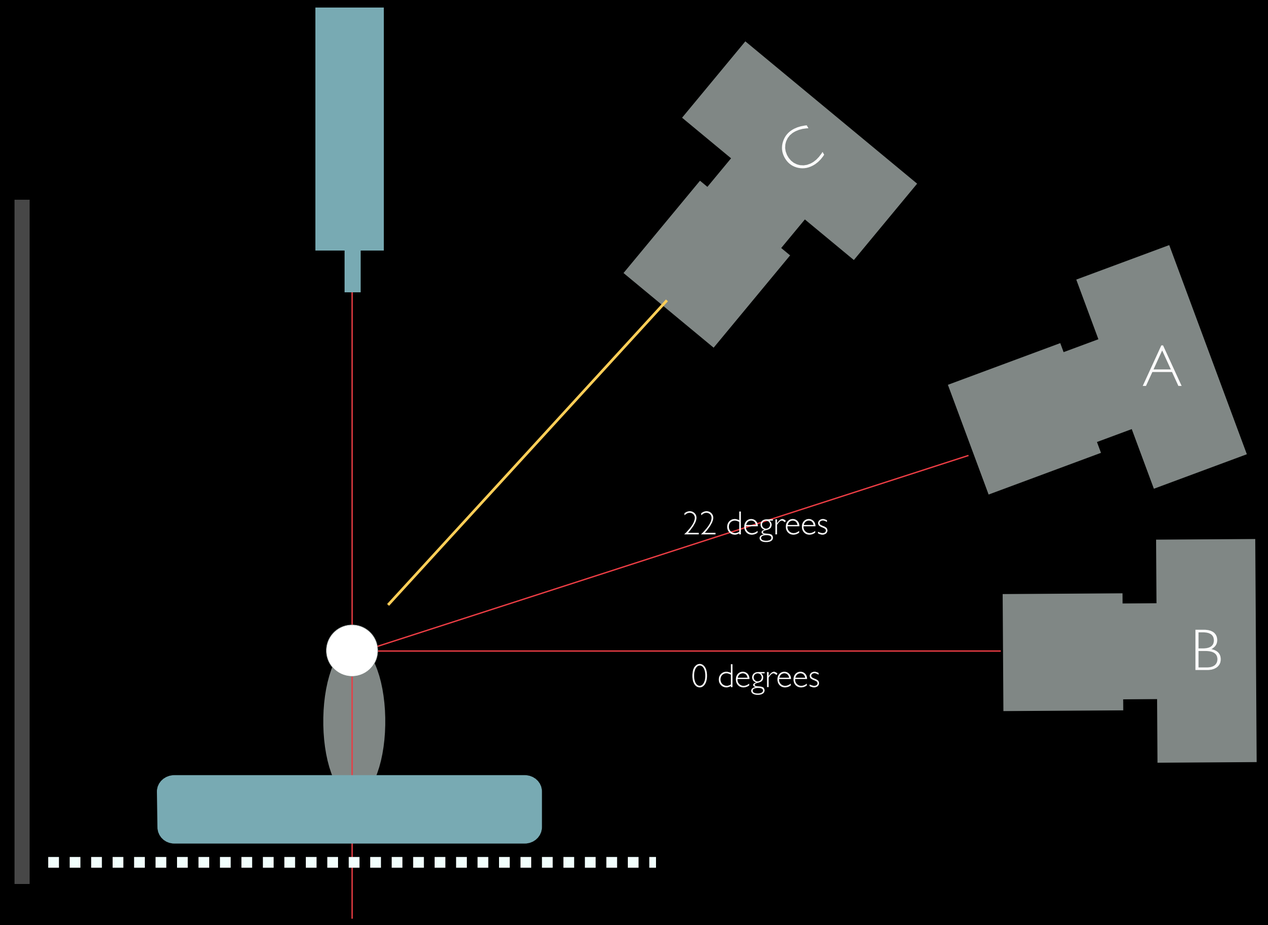
The vertical height of the camera will effect the vanishing point and **horizon** in the image (see examples)

The resulting images will be dramatically different and will help in minimizing post production.

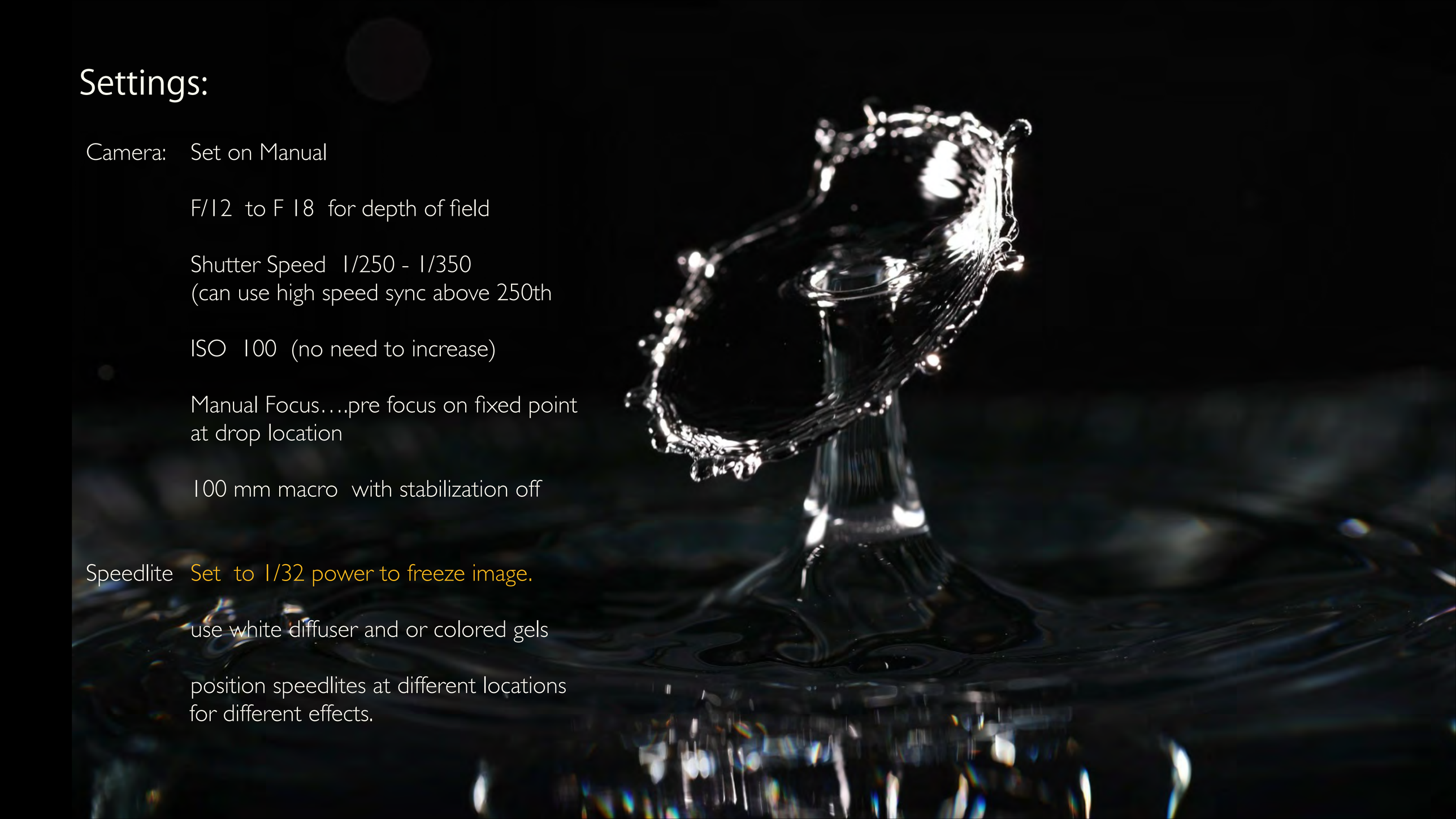
0 degrees at collision hight the horizon will be lat the bottom of the image

At 22 degrees the horizon will be higher at a midpoint in the image

no right or wrong just different!



# Settings:



Camera: Set on Manual

F/12 to F 18 for depth of field

Shutter Speed 1/250 - 1/350
(can use high speed sync above 250th

ISO 100 (no need to increase)

Manual Focus….pre focus on fixed point at drop location

100 mm macro with stabilization off

Speedlite Set to 1/32 power to freeze image.

use white diffuser and or colored gels

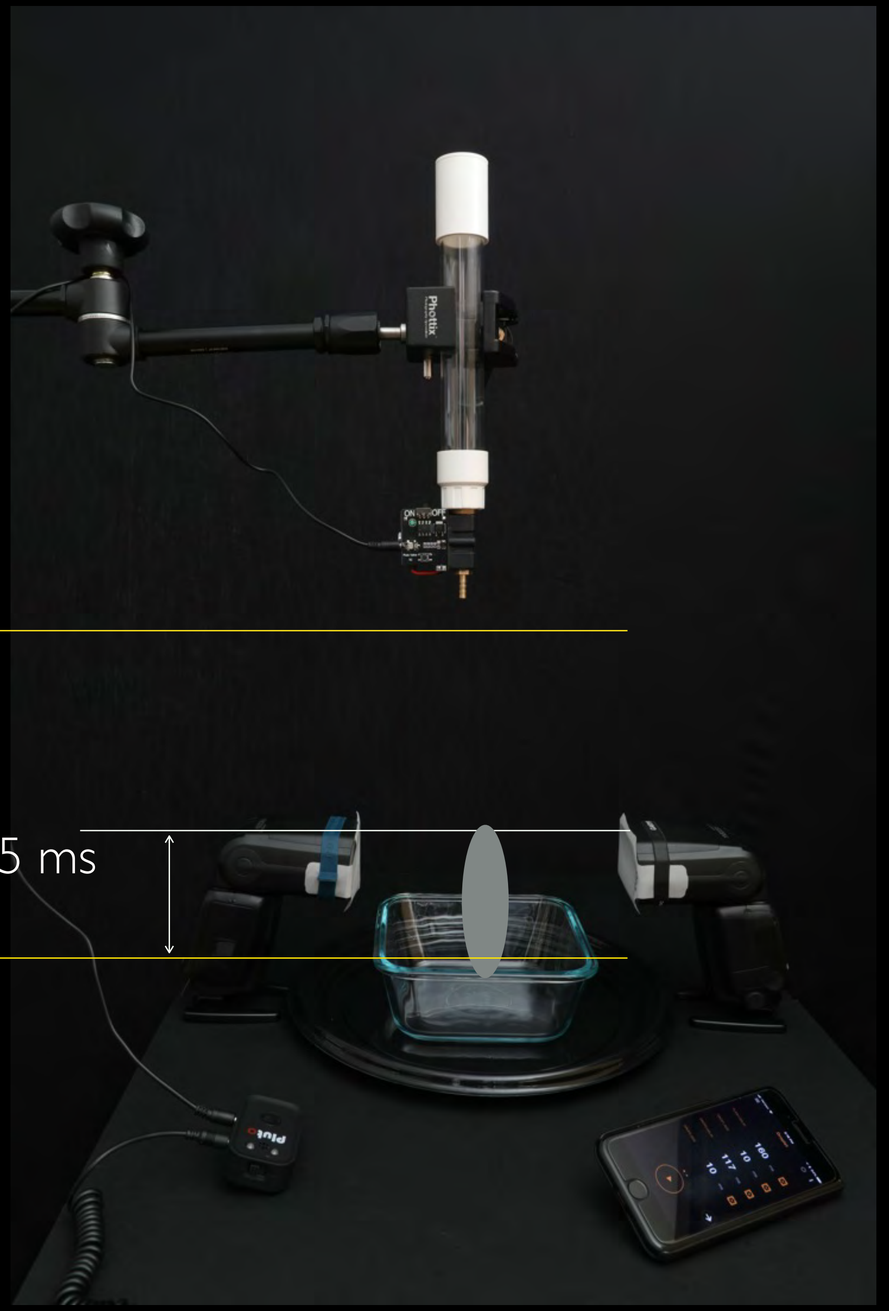
position speedlites at different locations for different effects.

# CALIBRATION DROP I

## DROP I

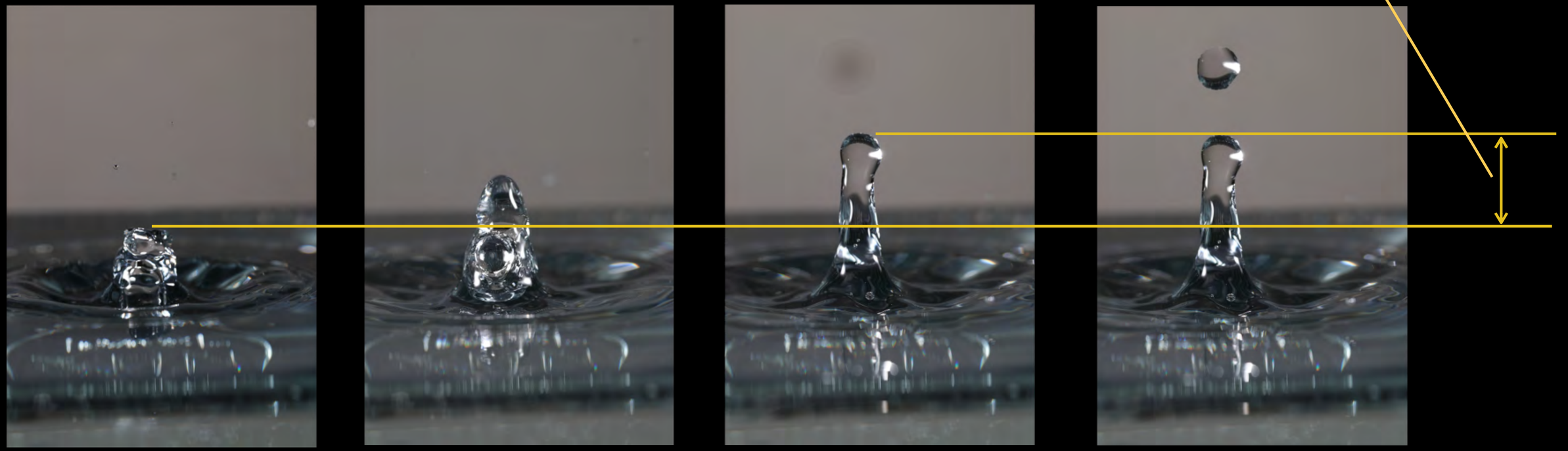
Drop size
Flash delay ( delay in shutter release)

Capture highest drop rebound- see examples



# CALIBRATION DROP 1

Continue to delay the shutter release until the 1st drop is at its highest point.



1 2 3

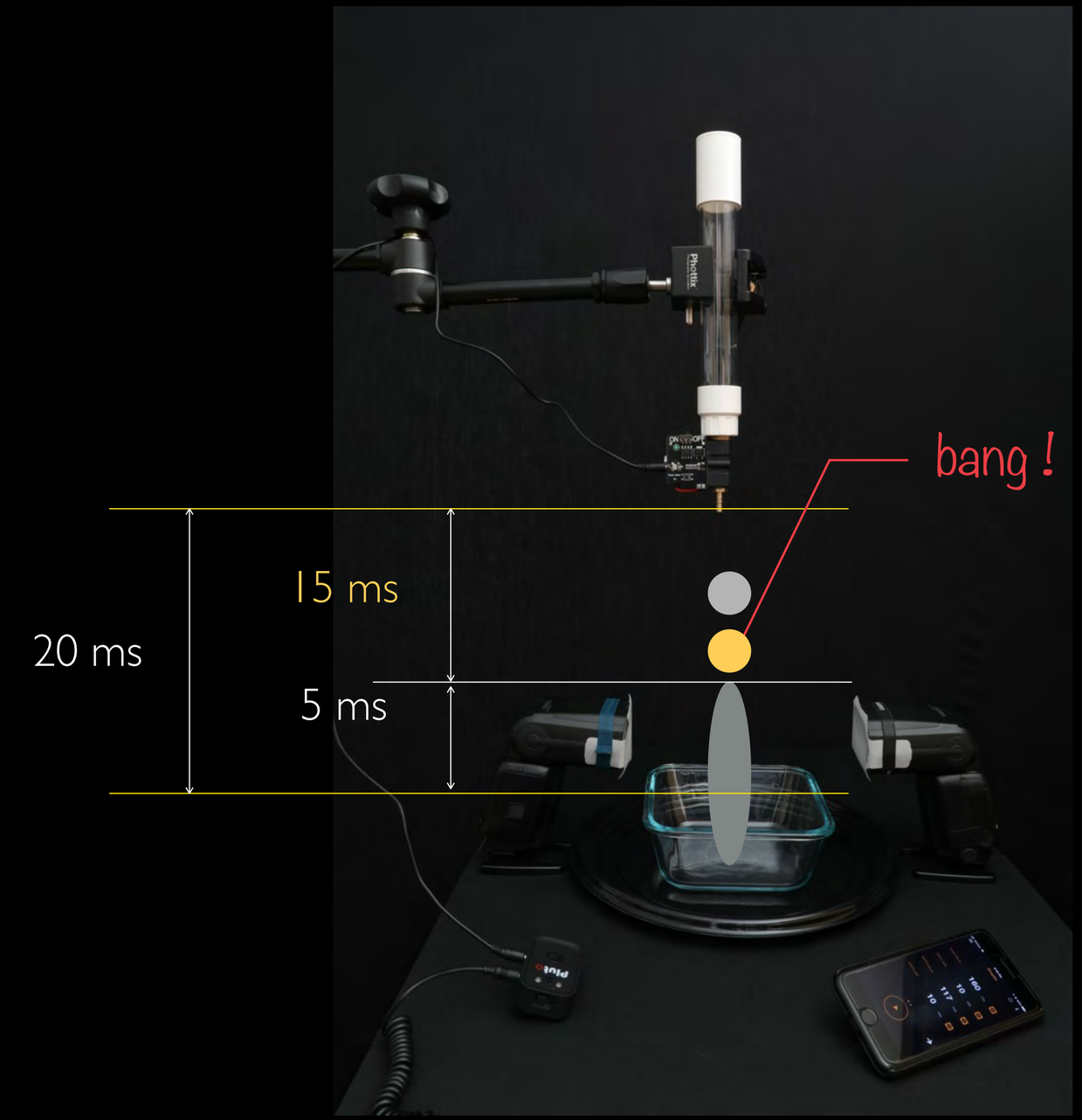
# CALIBRATION DROP 2

DROP 2

Drop size
2nd drop release delay

Timing to hit drop 1 rebound at highest point

In this example the delay would be 10 ms



COLLISION : SUCCESS!

It will take around 20 shots
to zone in.

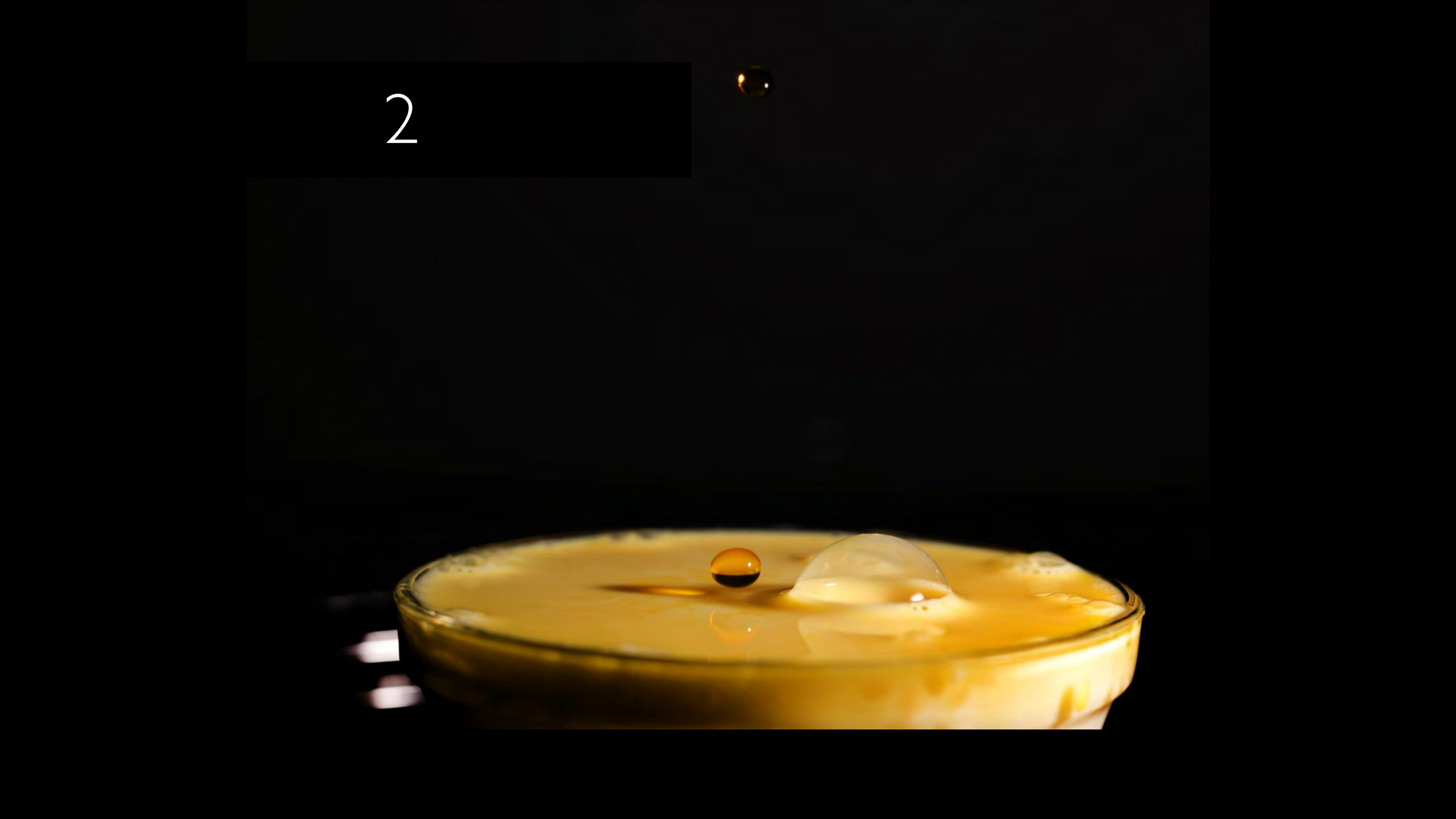
now experiment with
different colors and liquids…

Focus on creativity!

…….please no lighter fluid

# Drop Sequence

2



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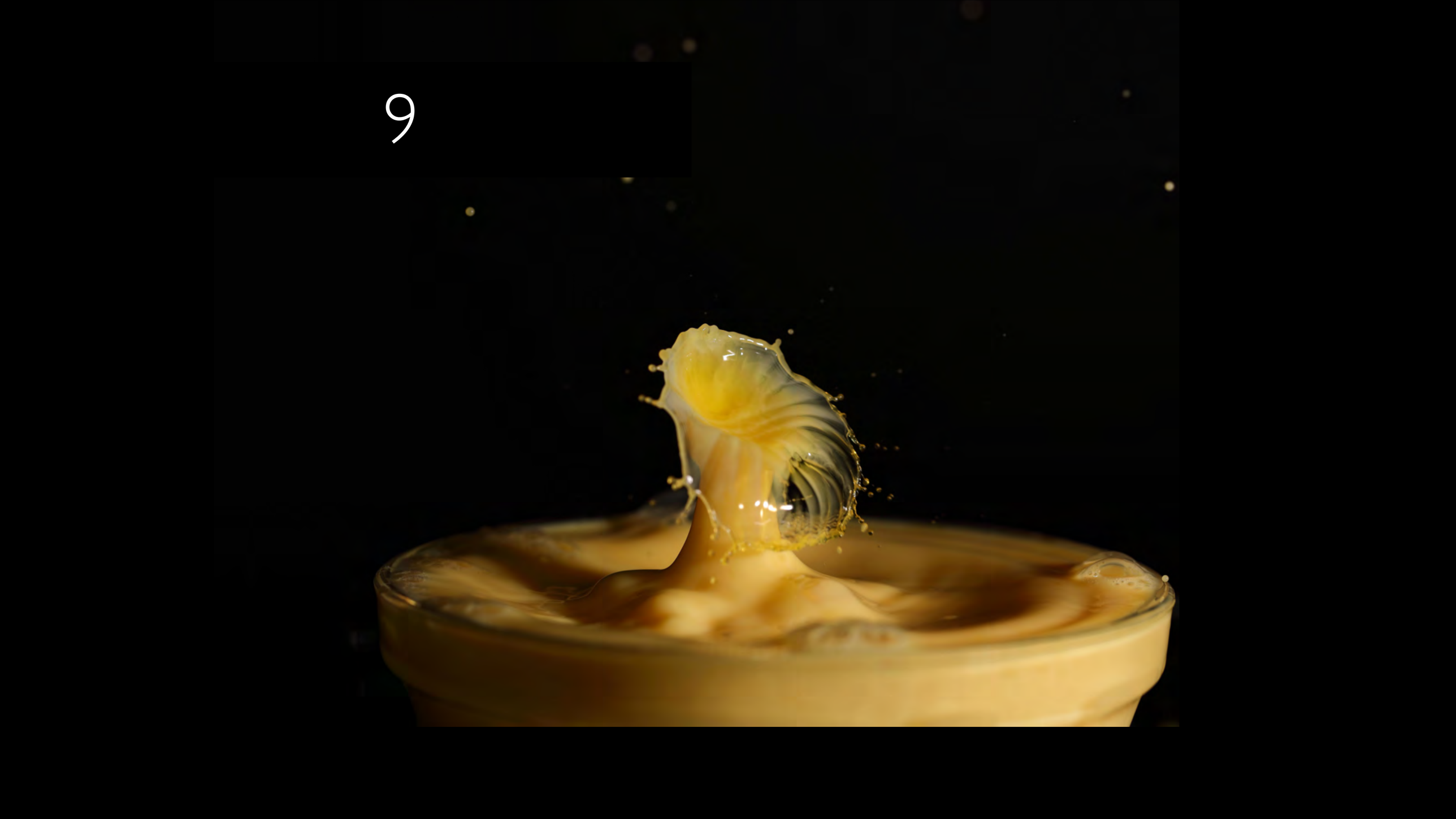


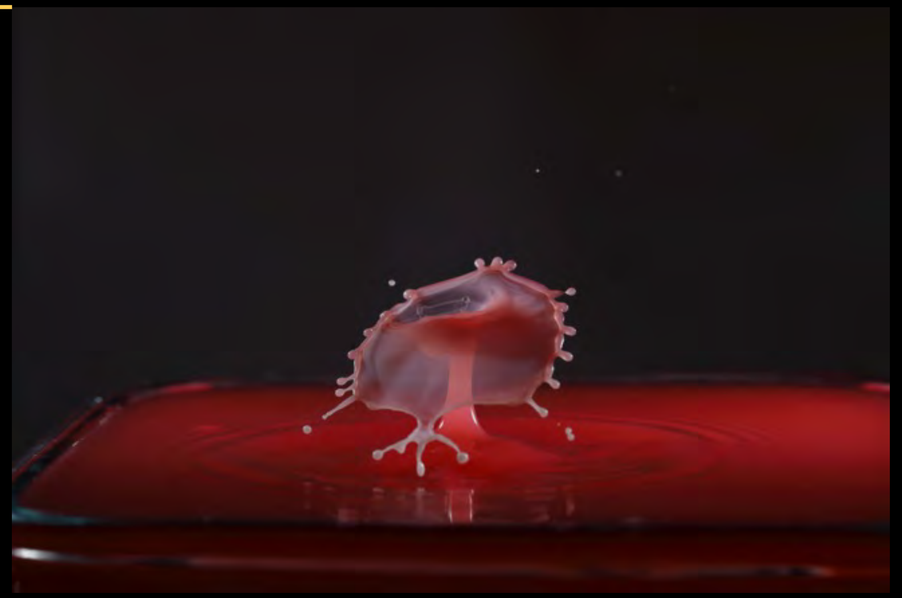
# Photoshop:

## Out of Camera

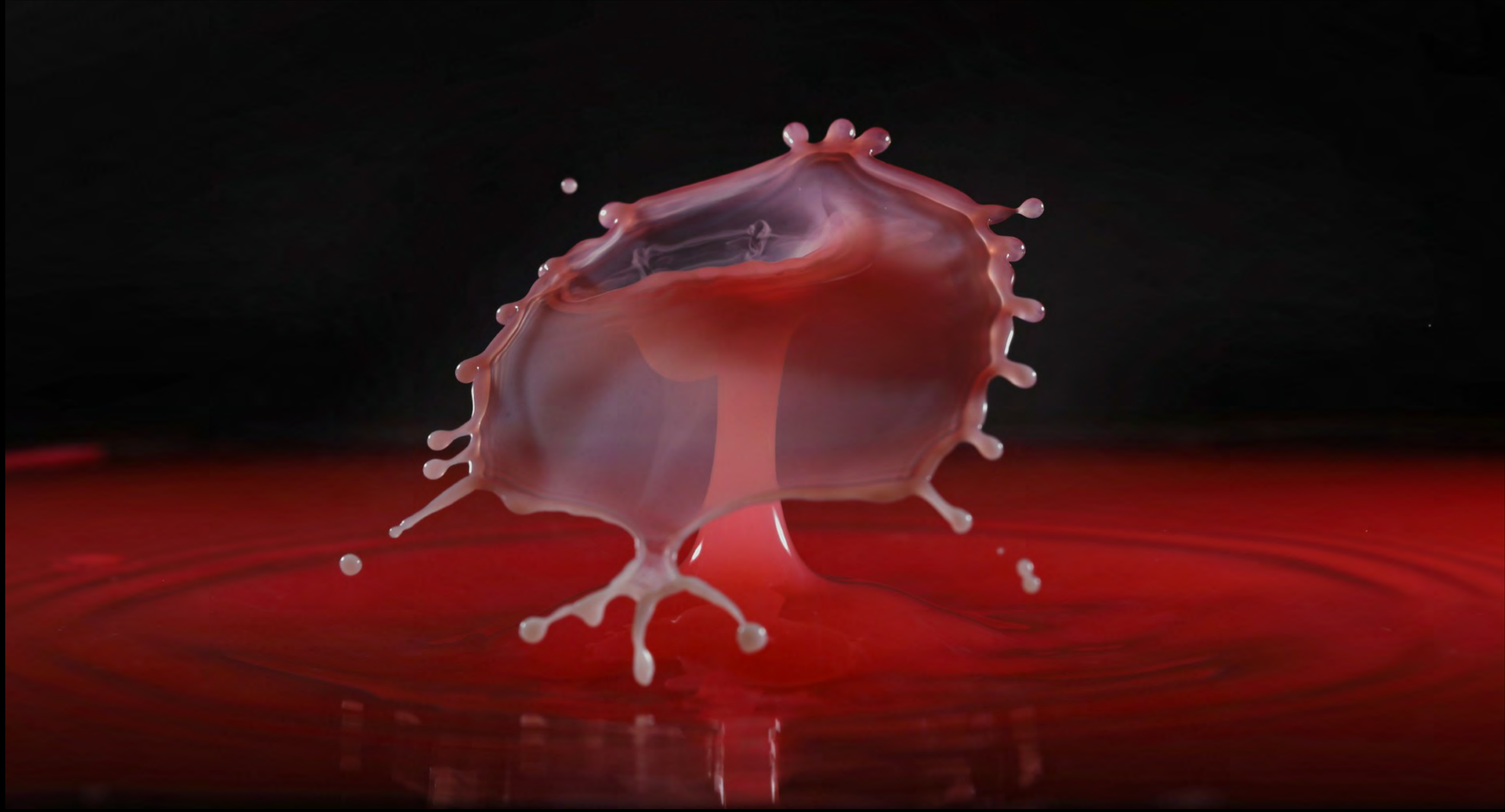
Using basic settings outlined in presentation

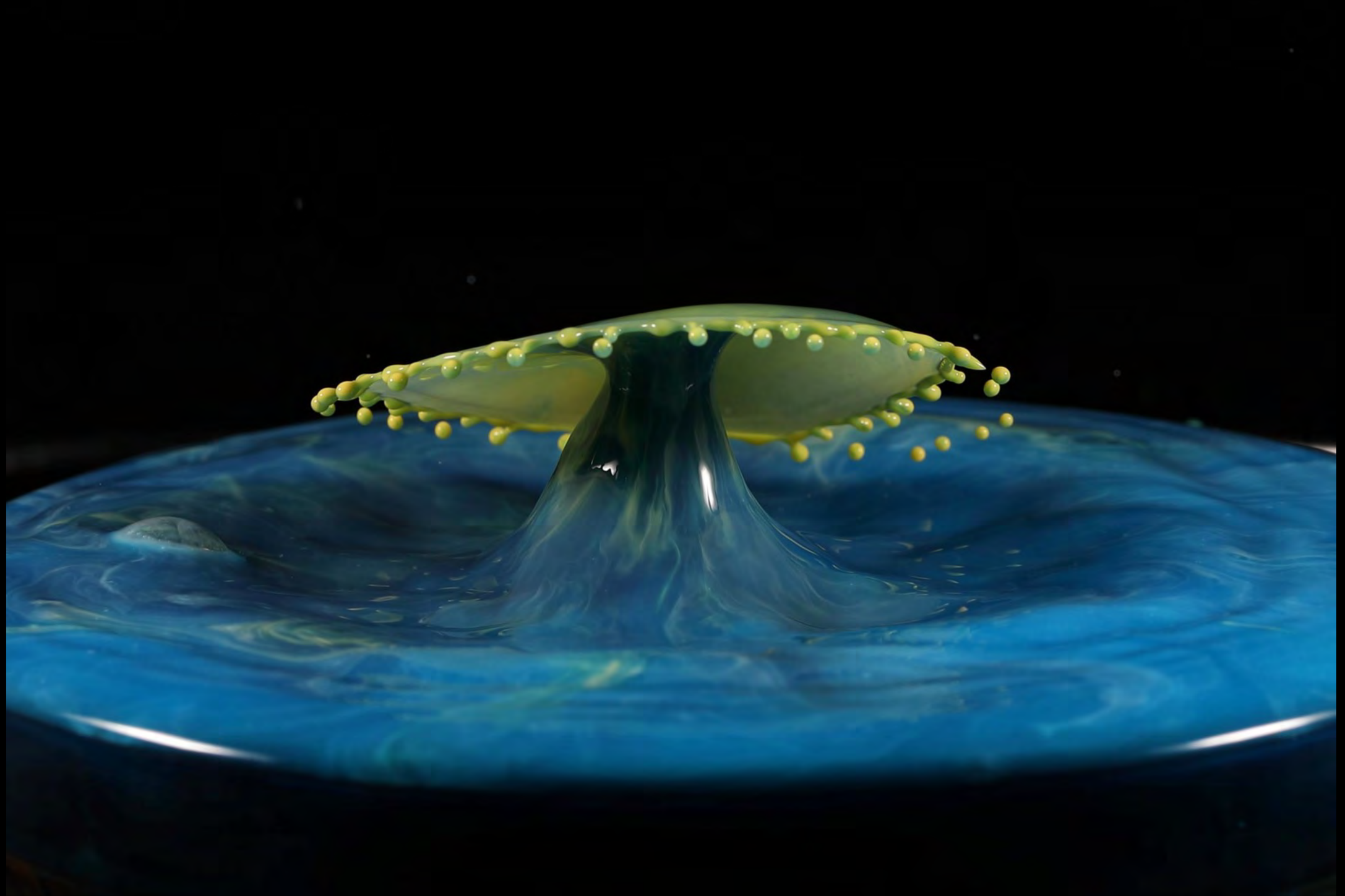
## Adjustment

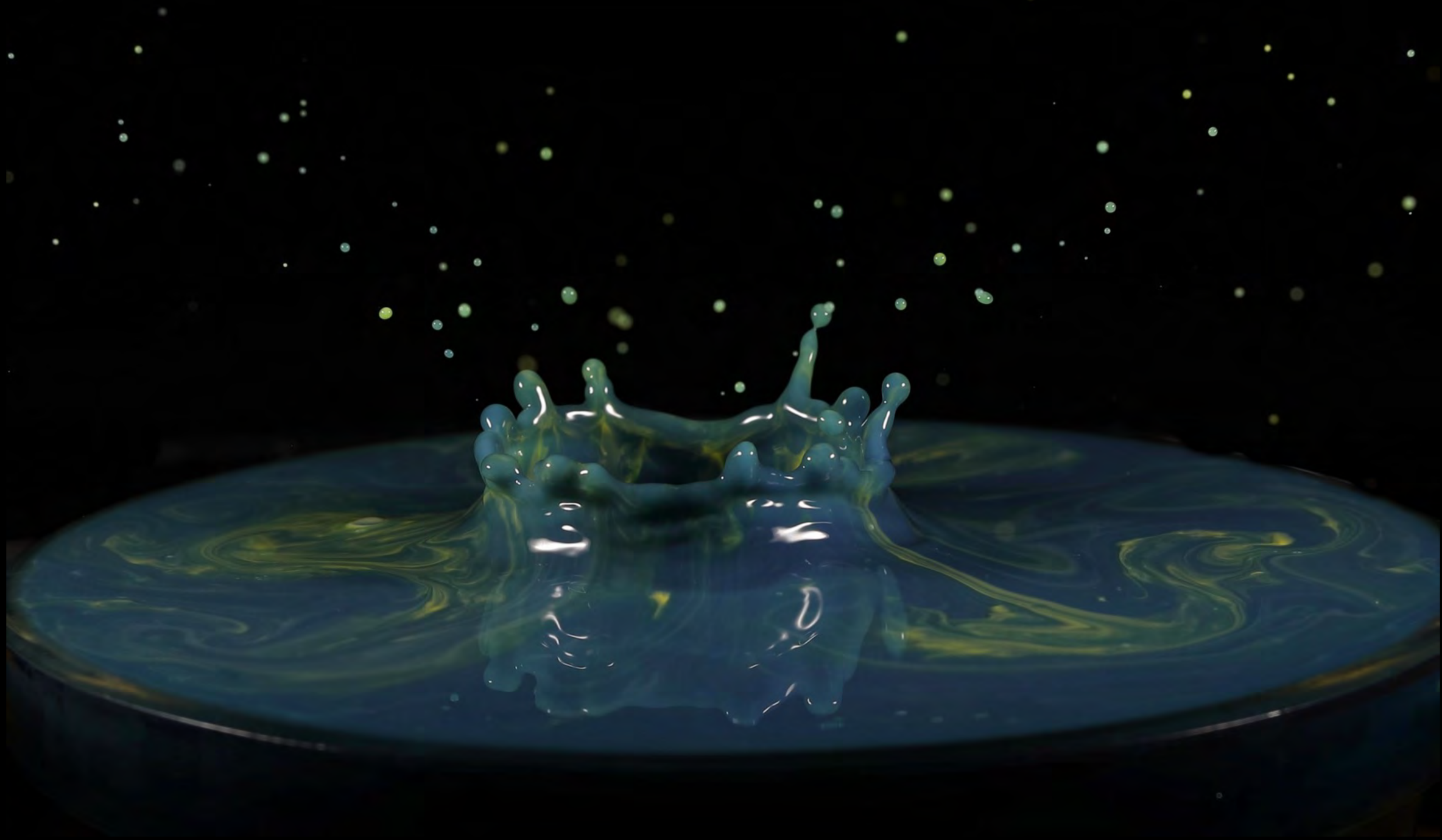
Adjust exposure - under expose to darken background.  Note Horizon line

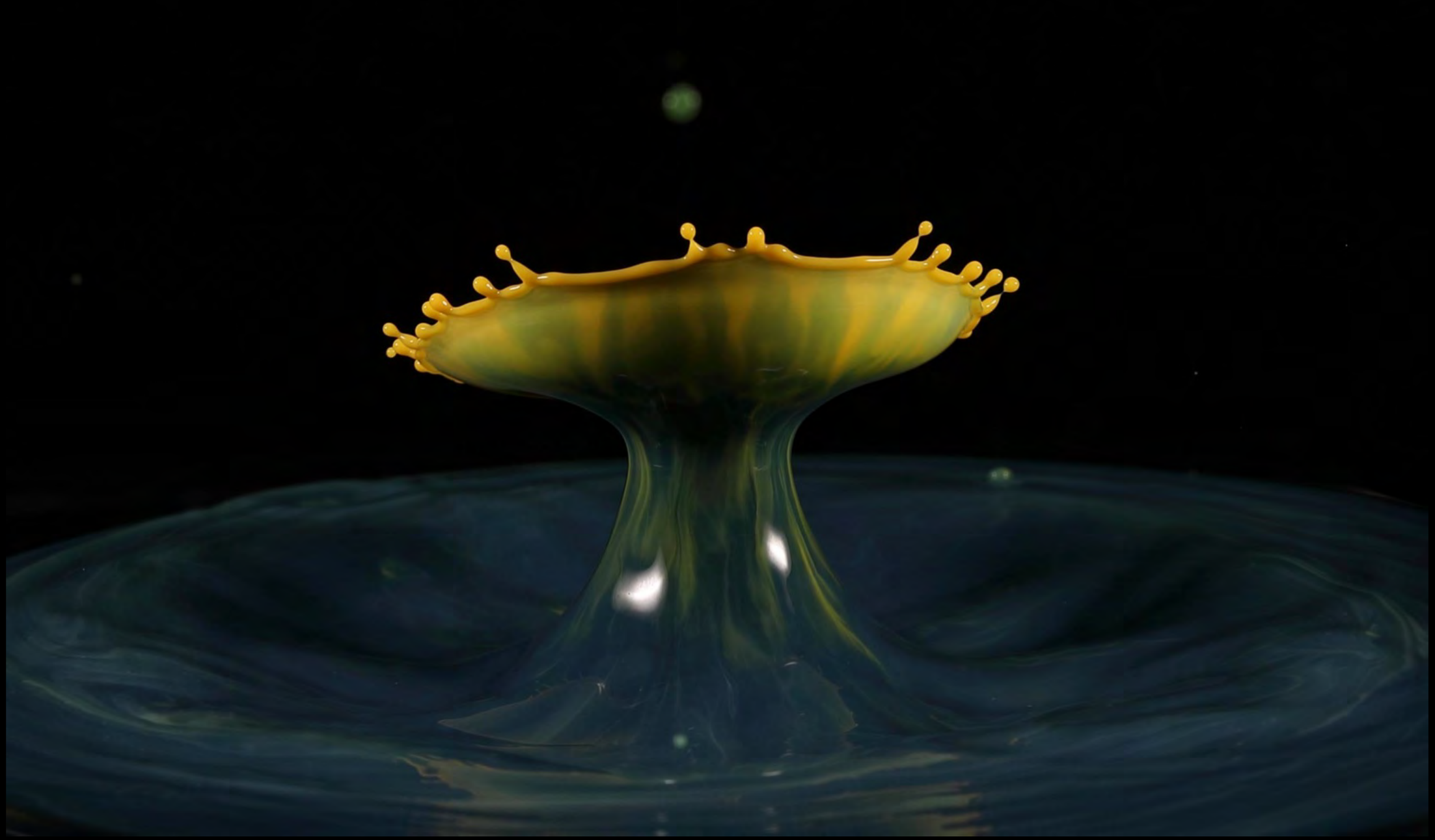


Crop Image- next slide

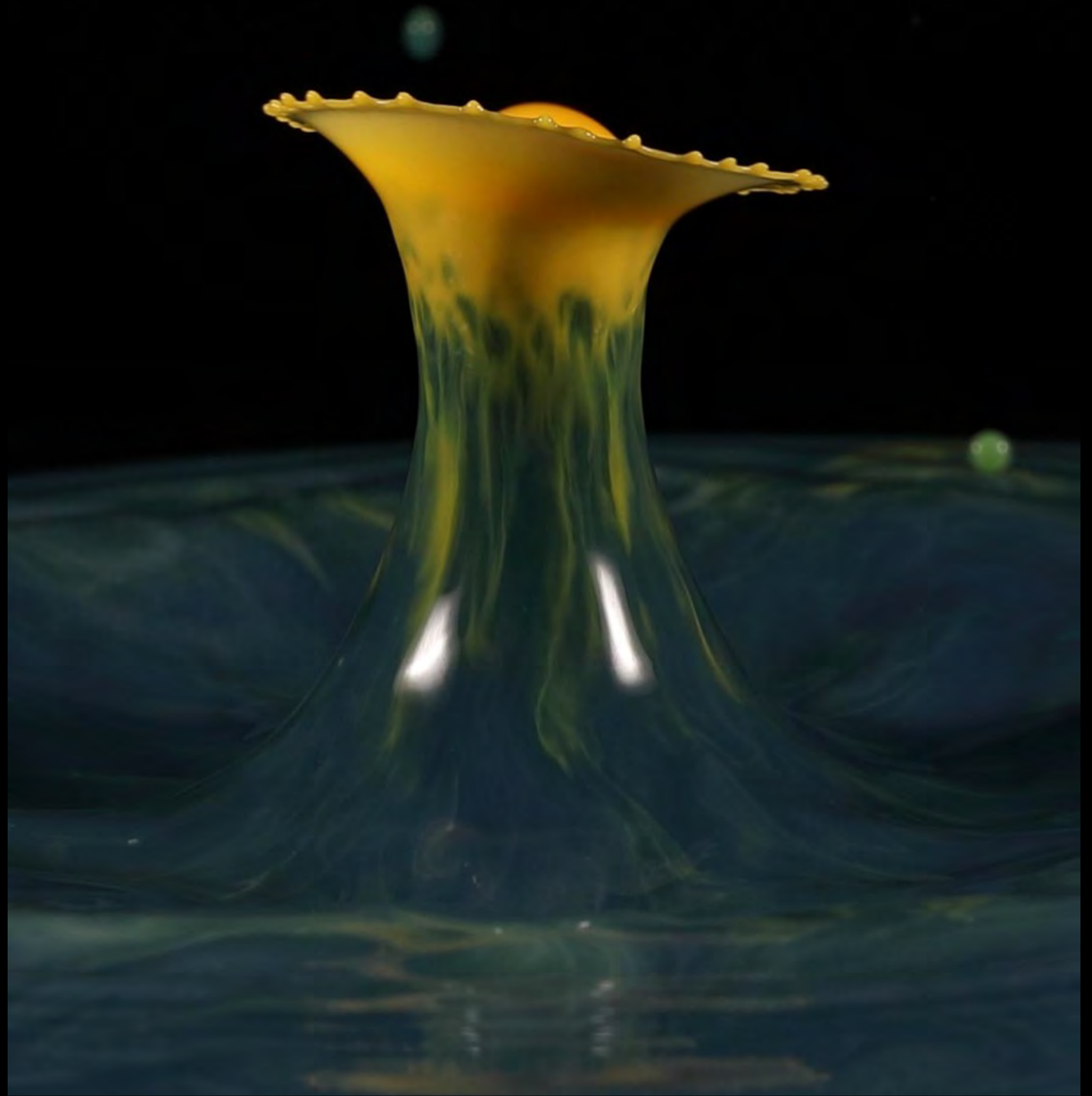








# Climate Change



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Starbucks Caramel Latte

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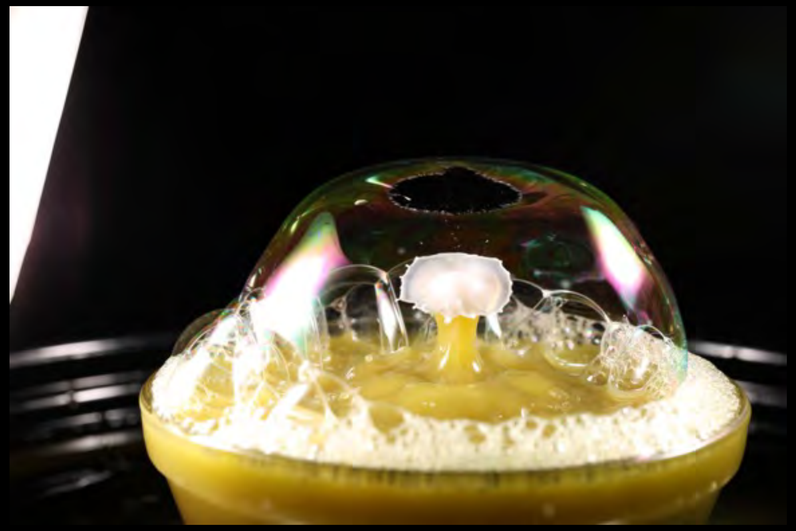

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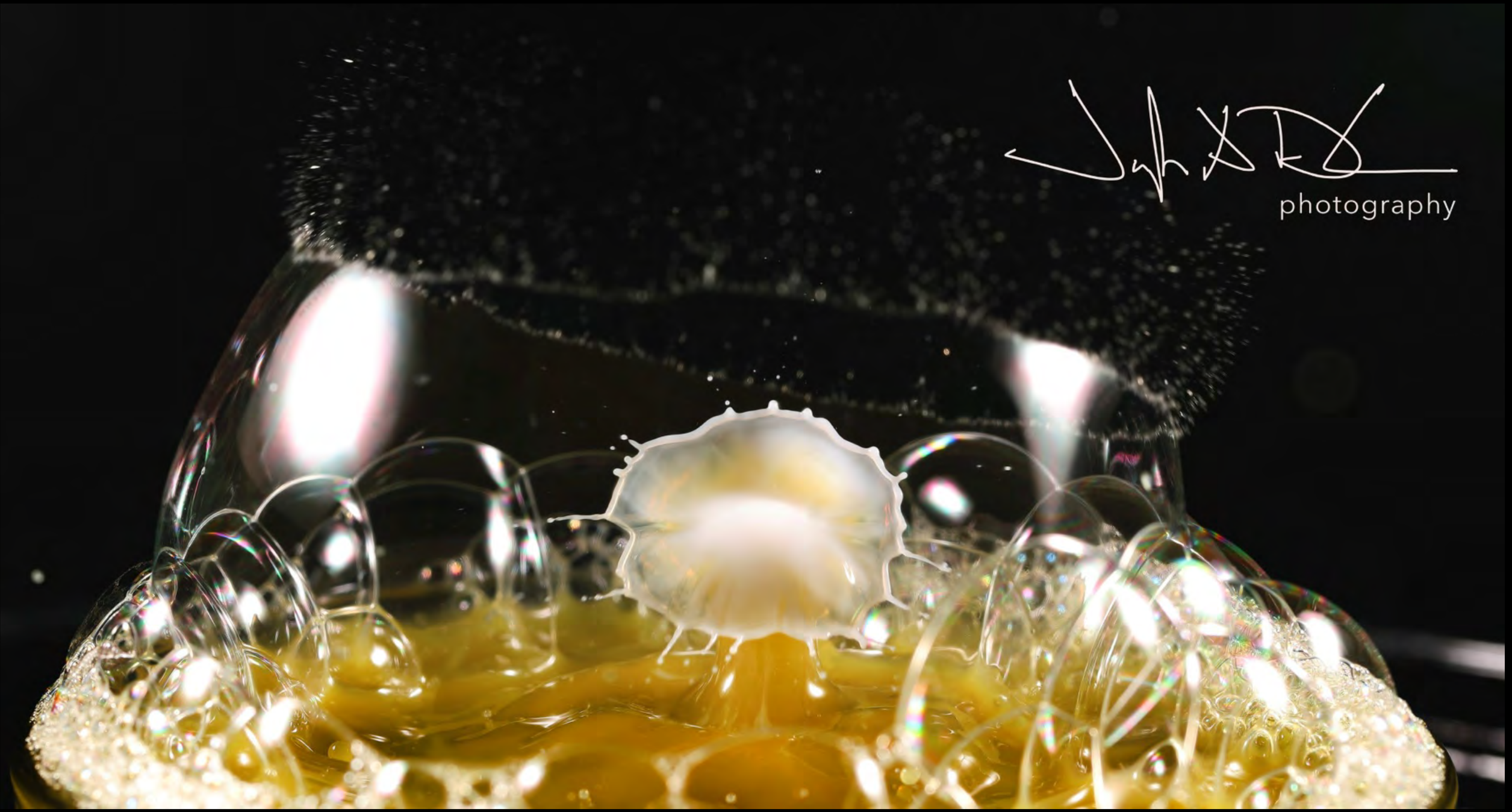
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# QUESTIONS