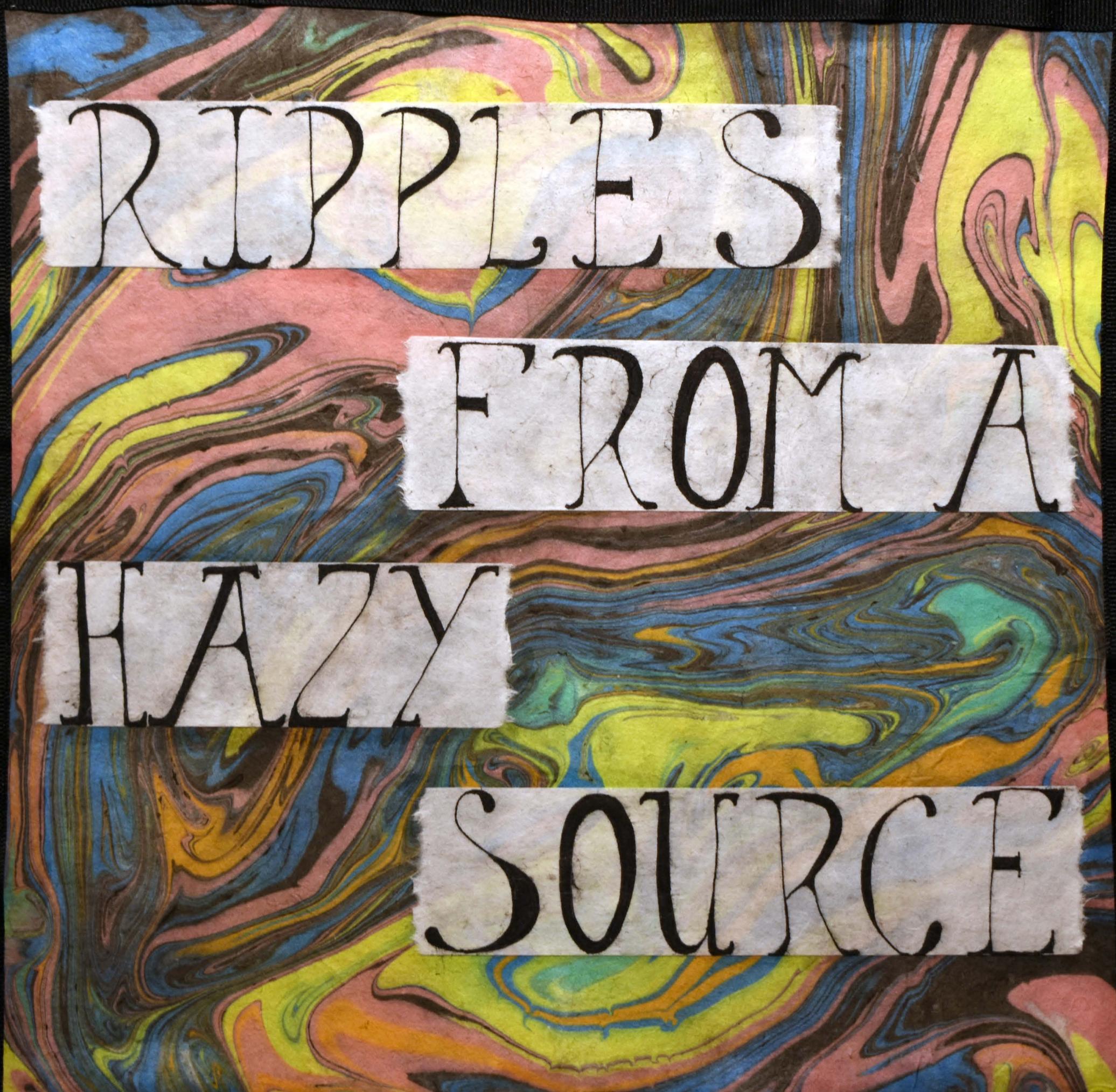


RIPPLES

FROM A

HAZY

SOURCE



UNIVERSE CUPCAKE RECIPE

Ingredients:

- Dark chocolate Frosting (69% of total cupcake)*
 - Water: 25.7%
 - Cocoa Powder: 23%
 - Flour: 17.9%
 - Baking Soda: 0.5%
 - Salt: 0.2%
 - Baking Powder: 0.1%
 - Butter: 12.4%
 - Sugar: 27.3%
 - Eggs: 12.5%
 - Vanilla Extract: 0.3%
 - Instant Coffee: 0.8%

- Dark Chocolate Frosting (26.4%)*
 - Unsalted butter, softened: 27.5%
 - Vanilla Extract: 0.7%
 - Salt: 0.3%
 - Cocoa Powder: 26%
 - Powdered Sugar: 55.1%
 - Heavy Whipping Cream: 13.8%

- Sprinkles (4.6%)*
 - Sprinkles: 100%

* Measurements to preference

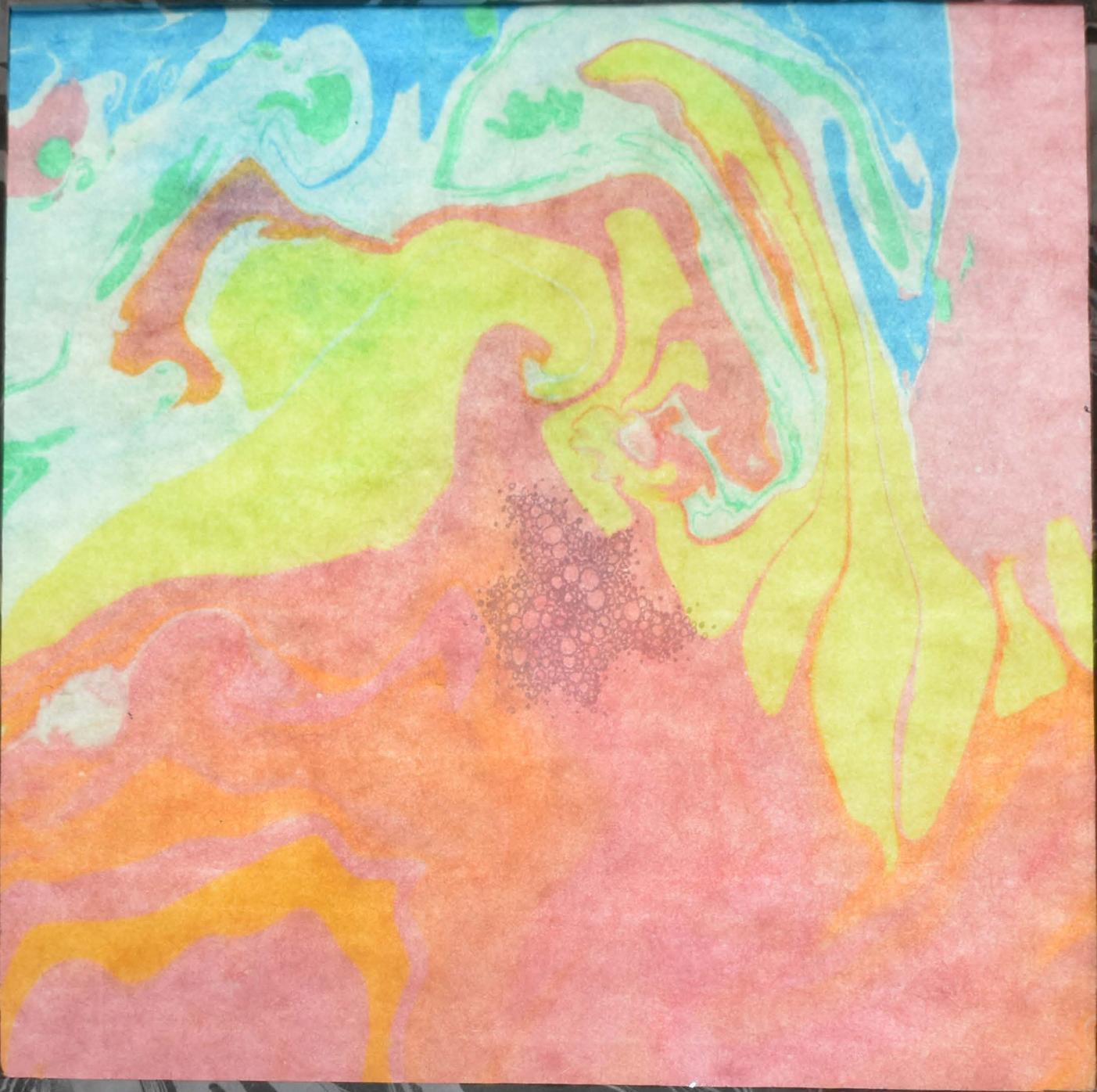
Directions

For cake batter:

- 1.) Find a cupcake tin that is large enough to hold the total contents of your cake once it has risen. Prevent the batter from sticking to it!
- 2.) Heat oven.
- 3.) Combine cocoa powder and water at around 373.2 K. Over time the cocoa will be evenly dispersed through the water.
- 4.) The dry ingredients will be observably white when mixed together. The other ingredients when combine will hold a more spiral and peaked shape.
- 5.) When combined together they will create a dark, thick batter (not too thick).
- 6.) Pour into the cupcake tin and put in oven. At an internal temperature of 372 K the cake will be completely uniform in texture.
- 7.) Remove from oven and allow to cool enough to not melt frosting

For Frosting

- 1.) Cream together butter, vanilla and salt. Add the other ingredients. It should look dark and uniform.
- Combine appropriate amounts of cake (69%), frosting (26.4%) and sprinkle (4.6%)



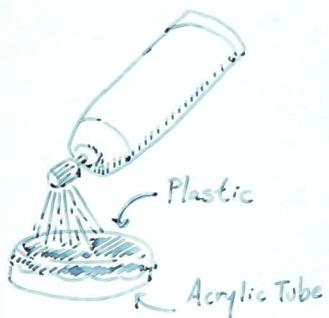
BOLOMETER ANALOG

Materials:

- Germanium Lens
- Thin Plastic Shopping Bag
- Thermochromic Liquid Crystal
- Section of Acrylic Tube the Diameter of the Lens
- Black Spray Paint

Directions:

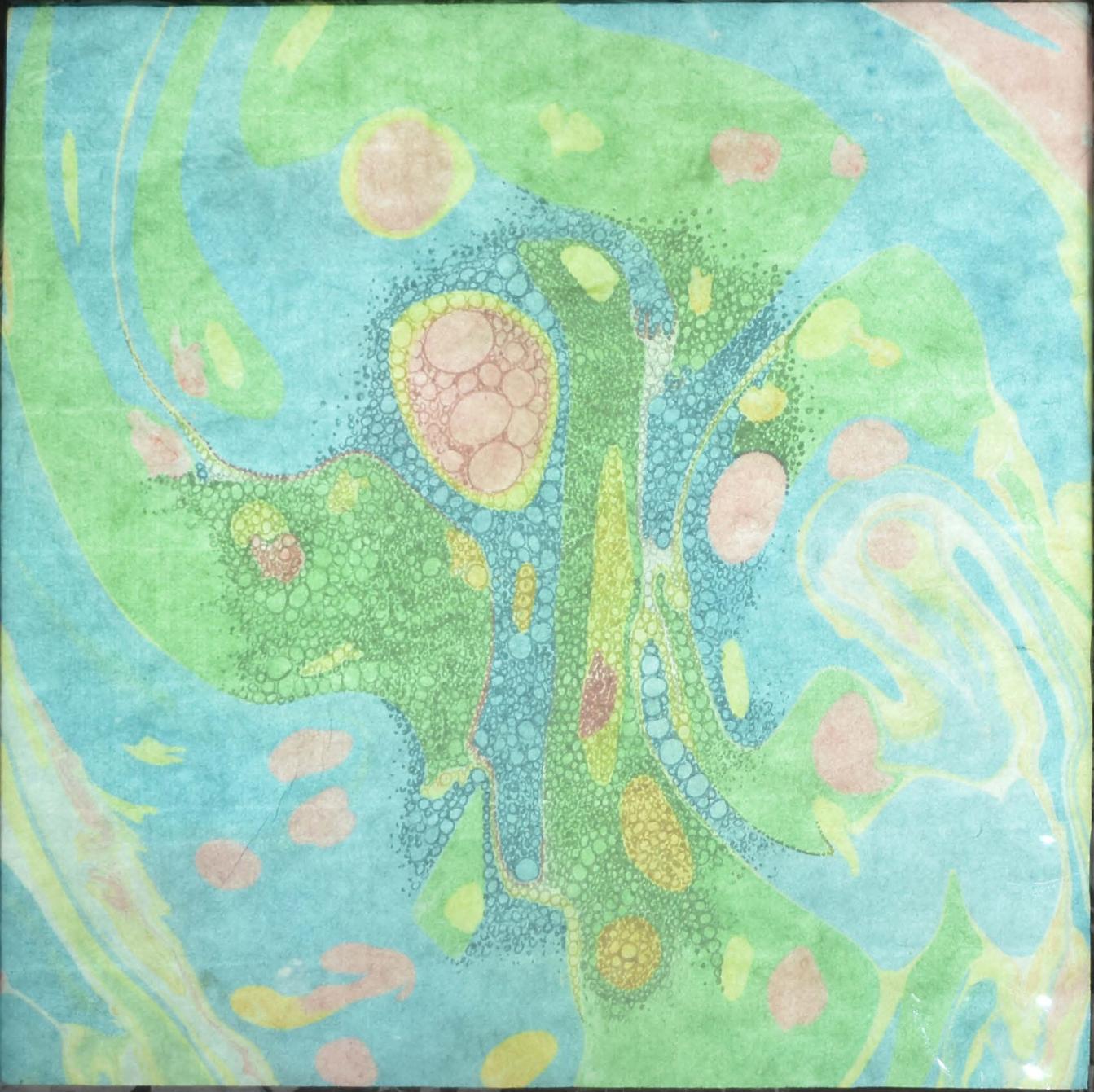
Stretch And Adhere Plastic Bag Over One Opening of The Thin Acrylic Tube. Spray A Thin Layer Of Paint Over The Plastic Film. Once The Black Paint Layer Is Dry, Lightly Coat The Film In The Liquid Crystal.



Attach Germanium Lens To The Other Side Of The Tube.

Find A Patch Of Ground Outside On A Clear Day

And Draw Out A Map Of The Sky Immediately Above The Space You Are Sitting. Hold Up The Lens So The Liquid Crystal Painted Side Is Facing You. Slowly Move It Across The Patch Of Sky You Draw. As You Move It, Color In The Map With The Corresponding Colors On The Lens.



n-BODY GRAVITATIONAL LENS ANALOG

Materials:

- Clear Acrylic Water Basin
- Drawing Pins (Tacks)
- Carbon Fiber Rods
- M3-Screws
- Plastic Washers
- Fuji X-Pro 2 (or Camera of equivalent strength)
With XF60 mm F2.4R Macro Lens (or equivalent) and
Large f-stop ≥ 16

Directions:

To Produce A Gravitational n-body Lensing Analog, Fill A Clear Acrylic Pool With Water. Attach Two Carbon Fiber Rods To Either End of One Side of The Basin (Diameter $\varnothing = 0.5\text{mm}$) With M3-Screws And Two Plastic Washers. Attach n Solid Discs (Drawing Pins) To Support Rods With Super Glue So The Flats Of The Pins Are Held Above The Unperturbed Water Level. Mount The Basin In Such A Way That You Can View Through It With A Camera. To Calculate The Slope of The Liquid Surface Perturbation $z = f(x, y)$, Use The Linearized Young-Laplace Equation

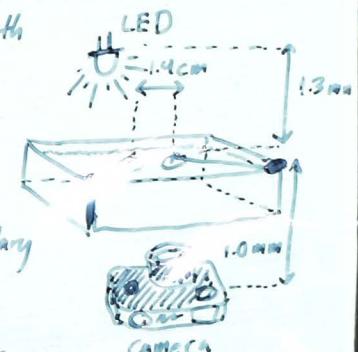
$$\nabla^2 f = \bar{a}^2 f.$$

where a Is The Capillary Length Of The Water, and Solve For The Proper Boundary Conditions. Light Will Be Deflected At The Interface f By An Angle

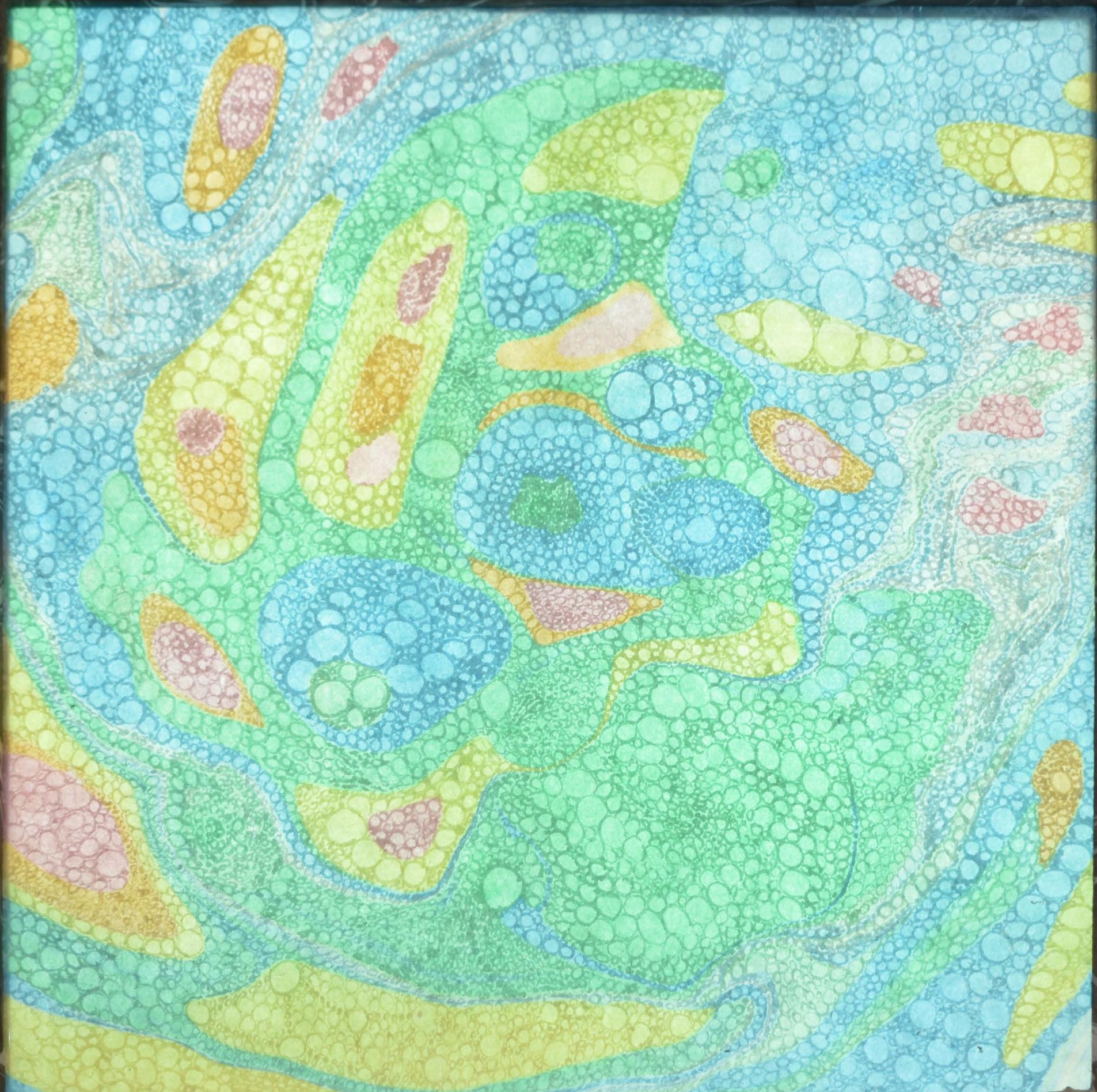
$$\vec{\alpha} = (n-1) \nabla_{xy} f$$

where ∇_{xy} Is The Gradient Operator ~~of The Liquid~~ Acting On The xy -Plane. Use a Distant Conventional Whitish LED Light As A Light Source. Set Up The Camera Under The Water Basin To Record The Lensing of Light.

To Look At A Single Mass Gravitational Lens ($n=1$), For The Case Of A Single Track Of Radius R , Set $f(r)|_{r=R} = h$, And The Angular Einstein Ring Radius θ_E (1.0mm , 1.3mm) May Be Computed For The Approximate Profile $f = h \exp(-|r-R|/a)$. In Experiments $\theta_E \sim 1^\circ$.



Credit: "An Optical n-body Gravitational Lens Analogy" (Selmke, Markus)



THOUGHT EXPERIMENT

Go Outside And Sit Silently On The Ground For Several Minutes, Until You Hear Or See Something You Can't Immediately Explain. Without Moving, Write Down Everything You Can Observe Around You That Might Have Caused It.

Continue To Sit Where You Are And Go Through Your List, Attempting To The Fullest Extent Of Your Ability To Prove It.

If You Reach The End Of That List Without A Provable Conclusion, Write Down All The Things That Could Have Conceivably Caused It, Regardless Of Whether You Can Observe It In Your Immediate Vicinity.

Without Moving, Go Through Your List And Attempt To The Fullest Extent Of Your Ability To Prove Each Hypothesis.

If You Reach The End Of Your List Without A Provable Conclusion, Write Down What Happened And What Caused It.

EXPERIMENTAL LENS ANALOG

Notes

Dark Lens Box
Soda & Salt
Marble
Soda Water
Soda Water
Wax Paper (or equivalent strength)
White P.E.R. Plastic Wrap (or equivalent) about
one-half cup 2.56

Directions

To Today's Project you'll need a shallow dish, full of Soda Water, but with Water added to it so that it is only half full of water. Place around this shallow dish the Experimental Lens. This Area should have the experimental under Lens. Place White Soda Wax Paper over the Top Area. Then wrap Plastic Wrap over the Experimental Lens. You may wrap the Plastic Wrap around the Experimental Lens.

1. Cover Plastic Wrap with Soda Water. You may wrap Plastic Wrap around the Experimental Lens.

2. Add Soda Water to the Experimental Lens. You may wrap Plastic Wrap around the Experimental Lens.

The image shows a vertical, hand-drawn artwork. At the top, the word "RIPPLES" is written in large, black, outlined letters on a white rectangular panel. Below it, another white panel contains the words "FROM A". To the left of these panels, the word "HAPPY" is written in large, black, outlined letters on a white rectangular panel. At the bottom, a white panel contains the words "SOURCE". The entire artwork is set against a background of colorful, swirling marbled patterns in shades of pink, blue, yellow, and green.

~~String (26.9%)~~ * Sprinkles (4.6%)
~~Attenuated: 27.5%~~ - Sprinkles: 100%
7.7%
1%
5.1%
or: 13.8%

* Measurements to preference

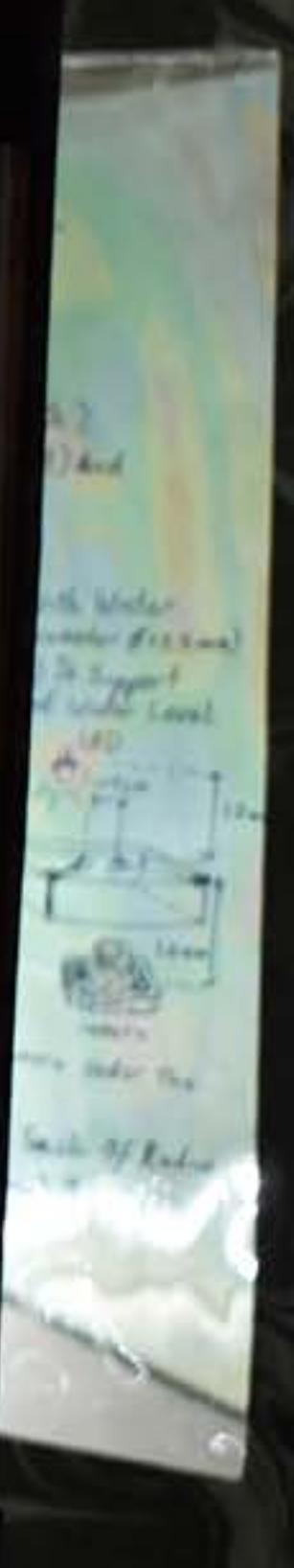
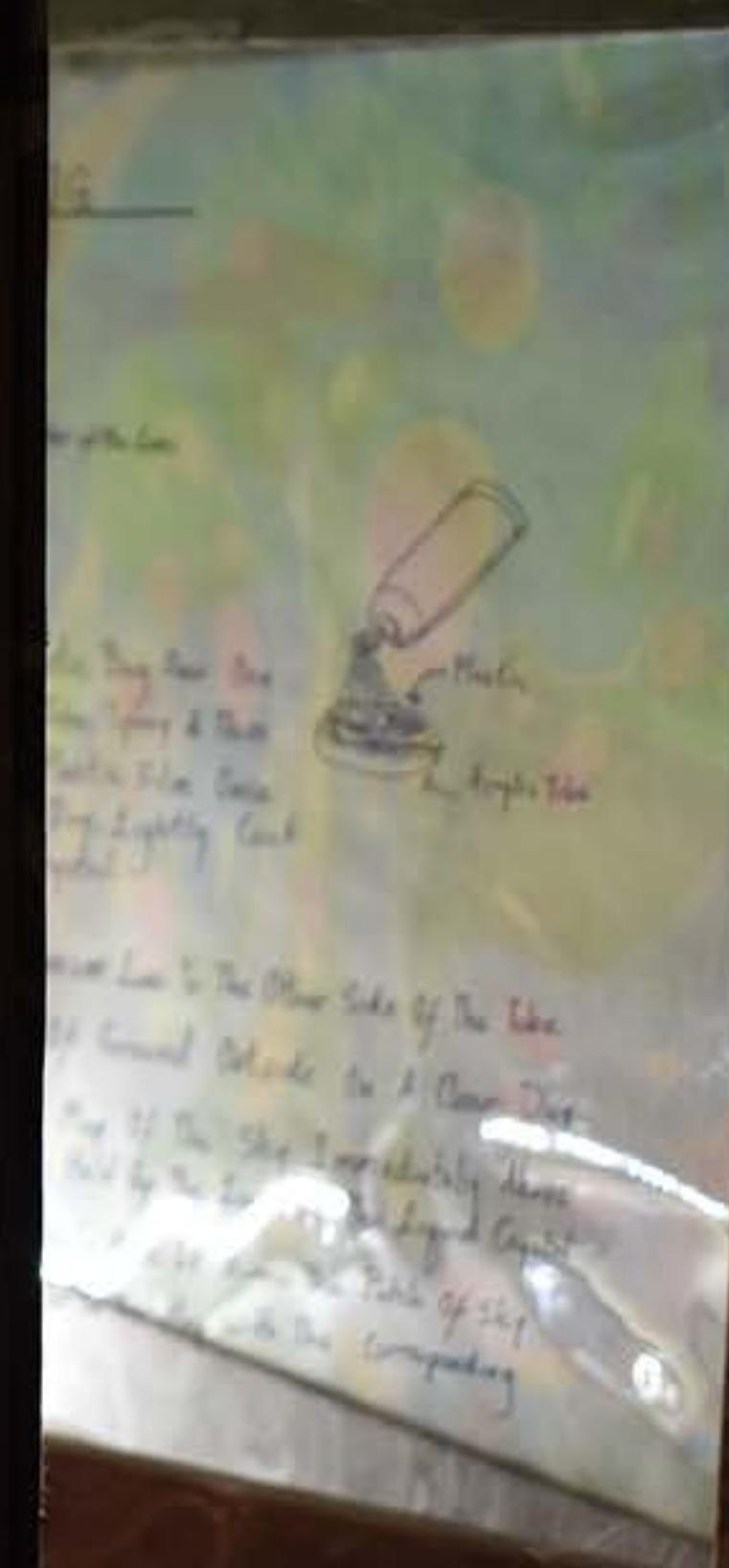
Turn out the cake when it has risen.

the colour will be evenly dispersed throughout.

The other ingredients when combine will
alter (not too much)

at the rate of 372 K the cycle will be completed.

It should be dark and uniform
in size (4.6%).



UNIVERSE CUPCAKE RECIPE

Ingredients:

- Dark Chocolate Frosting (10% of total cupcake)*
- Water: 25.7%
- Cocoa Powder: 2.3%
- Flour: 17.9%
- Baking Soda: 0.5%
- Salt: 0.2%
- Baking Powder: 0.1%
- Butter: 12.8%
- Sugar: 27.3%
- Eggs: 12.5%
- Vanilla Extract: 0.3%
- Instant Coffee: 0.7%

* Sprinkle (10%)
Sprinkle (0.3%)

Directions:

- For cake batter:
- 1) Find a cupcake tin that is large enough to hold the total contents of your cake mix if the mix is for one cupcake.
 - 2) Heat oven.
 - 3) Combine cocoa powder and water at room 22°C . Over time, the cocoa will be evenly dispersed through the water.
 - 4) The dry ingredients will be desirably white when mixed together. The other ingredients when combined will hold a more spiral and peaked shape.
 - 5) When combined together they will create a dark, thick batter (not too fluid).
 - 6) Pour into the cupcake tin and put in oven. At an internal temperature of 222°K the cake will be completely solidified in texture.
 - 7) Remove from oven and allow to cool enough to set with frosting.

Frosting

- 1) Cream together butter, vanilla and salt. Add the other ingredients. It should look dark and uniform.
- 2) Continue creaming until most of cake (99%), frosting (1.9%) and sprinkle (0.1%)

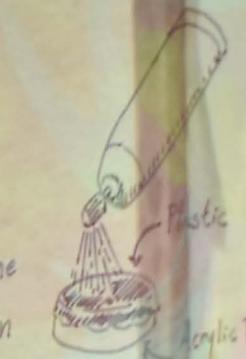
BOLOMETER ANALOG

Materials:

- Germanium Lens
- Thin Plastic Shopping Bag
- Thermochromic Liquid Crystal
- Section of Acrylic Tube The Diameter of the Lens
- Black Spray Paint

Directions:

Stretch And Adhere Plastic Bag Over One Opening of The Thin Acrylic Tube. Spray A Thin Layer Of Paint Over The Plastic Film. Once The Black Paint Layer Is Dry, Lightly Coat The Film In The Liquid Crystal.



Attach Germanium Lens To The Other Side Of The Tube.

Find A Patch Of Ground Outside On A Clear Day

And Draw Out A Map Of The Sky Immediately Above The Space You Are Sitting. Hold Up The Lens So The Liquid Crystal Painted Side Is Facing You. Slowly Move It Across The Patch Of Sky You Draw. As You Move It, Color In The Map With The Corresponding Colors On The Lens.

PLANET LENS ANALOG

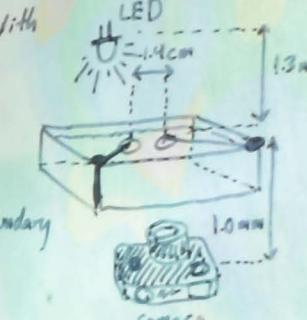
- M3-Screws

Plastic Washers

Fuji X-Pro 2 (or Camera of Equivalent Strength). With XF60 mm F2.4 R Macro Lens (or Equivalent) And Large f-Stop ≥ 16

Body Lenses Analog. Fill A Clear Acrylic Pool With Water. Tie Either End of One Side of The Basin (Diameter $\phi = 0.5\text{mm}$) To Solid Discs (Drawing Pins) To Support The Flats Of The Pins Are Held Above The Unperturbed Water Level. A Way That You Can View Through It With Slope Of The Liquid Surface Perturbation

Using Laplace Equation



of The Water, and Solve For The Proper Boundary At The Interface of By An Angle

of The Legend Acting On The xy-Plane. Use a LED Light As A Light Source. Set Up The Camera Under The Lens To Capture The Lensing of Light.

Angular Einstein Ring Radius A_E (1.0mm , 1.3mm) May Be Profile for $\exp(-(r-R)/a)$. In Experiments: $A_E \sim 1'$.

Planetary Lens Analogy/Schmidt

THOUGHT EXPERIMENT

Go Outside And Sit Silently On The Ground For Several Minutes, Until You Hear Or See Something You Can't Immediately Explain. Without Moving, Write Down Everything You Can Observe Around You That Might Have Caused It.

Continue To Sit Where You Are And Go Through Your List, Attempting To The Fullest Extent Of Your Ability To Prove It.

If You Reach The End Of That List Without A Provable Conclusion, Write Down All The Things That Could Have Conceivably Caused It, Regardless

Of Whether You Can Observe It In Your Immediate Vicinity.

Without Moving, Go Through Your List And Attempt To The Fullest Extent Of Your Ability To Prove Each Hypothesis.

If You Reach The End Of Your List Without A Provable Conclusion, Write Down What Happened And What Caused It.

n-BODY GRAVITATIONAL LENS ANALOG

Materials:

- Clear Acrylic Water Basin
- Drawing Pins (Tacks)
- Carbon Fiber Rods
- M3-Screws
- Plastic Washers
- Fuji X-Pro 2 (or Camera of Equivalent Strength)
With XF60 mm F2.4R Macro Lens (or Equivalent) And
Large f-stop ≥ 16

Directions:

To Produce A Gravitational n-body Leasing Analog, Fill A Clear Acrylic Pool With Water. Attach Two Carbon Fiber Rods To Either End of One Side of The Basin (Diameter $\varnothing = 0.5\text{mm}$) With M3-Screws And Two Plastic Washers. Attach n Solid Discs (Drawing Pins) To Support Rods With Super Glue So The Flats Of The Pins Are Held Above The Unperturbed Water Level.

Mount The Basin In Such A Way That You Can View Through It With A Camera. To Calculate The Slope of The Liquid Surface Perturbation $z=f(x,y)$, Use The Linearized Young-Laplace Equation

$$\nabla^2 f = a^2 f$$

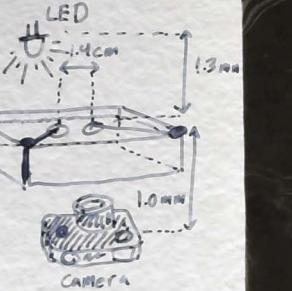
where a Is The Capillary Length Of The Water, and Solve For The Proper Boundary Conditions. Light Will Be Deflected At The Interface f By An Angle

$$[\vec{\alpha} = (n-1)\nabla_2 f]$$

where ∇_2 Is The Gradient Operator Of The Legend Acting On The xy-Plane. Use a Distant Conventional Whitish LED Light As A Light Source. Set Up The Camera Under The water Basin To Record The Lensing of Light.

To Look At A Single Mass Gravitational lens ($n=1$), For The Case Of A Single Tack Of Radius R , Set $f(r)|_{r=R}=h$, And The Angular Einstein Ring Radius θ_E (1.0mm , 1.3mm) May Be Computed. For The Approximate Profile $f=h \exp(-|r-R|/a)$ In Experiments $\theta_E \sim 1^\circ$.

Credit: An Optics n-body gravitational lens image by [John C. Hart](#)



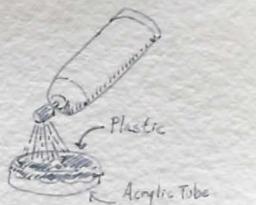
BOLOMETER ANALOG

Materials:

- Germanium Lens
- Thin Plastic Shopping Bag
- Thermochromic Liquid Crystal
- Section of Acrylic Tube the Diameter of the Lens
- Black Spray Paint

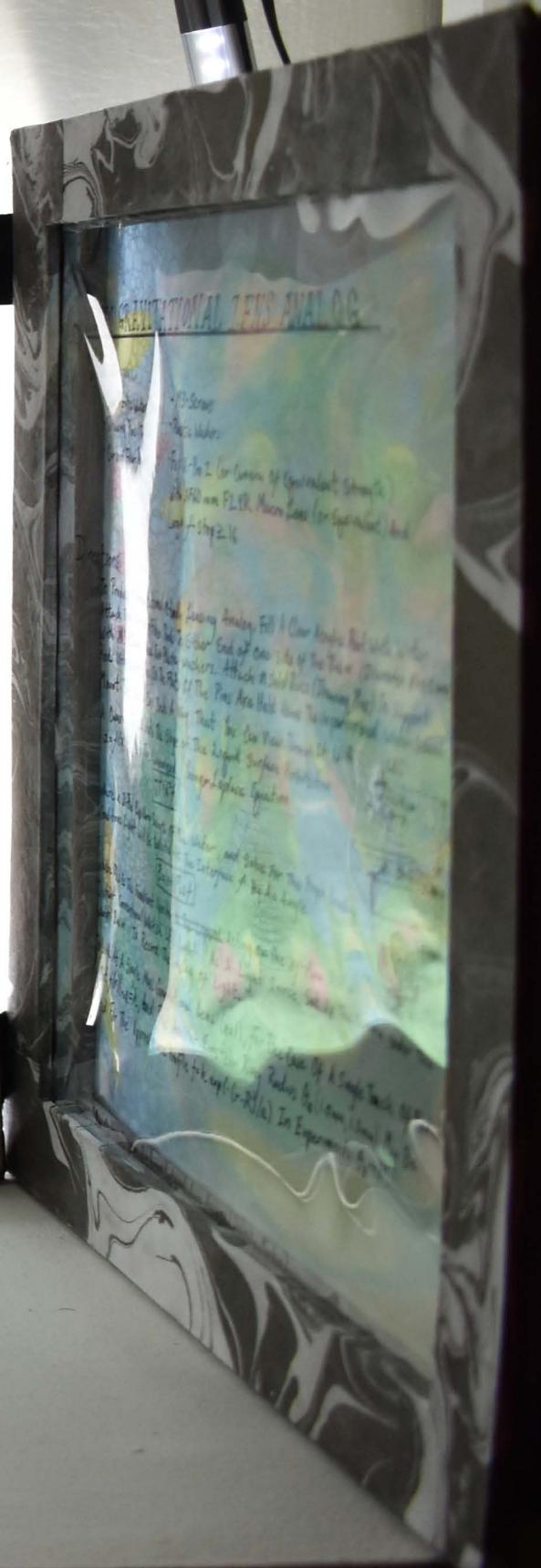
Directions:

Stretch And Adhere Plastic Bag Over One Opening of The Thin Acrylic Tube. Spray A Thin Layer Of Paint Over The Plastic Film. Once The Black Paint Layer Is Dry, Lightly Coat The Film In The Liquid Crystal.



Attach Germanium Lens To The Other Side Of The Tube. Find A Patch Of Ground Outside On A Clear Day

Lens
And Draw Out A Map Of The Sky Immediately Above The Space You Are Sitting. Hold Up The Lens So The Liquid Crystal Painted Side Is Facing You. Slowly Move It Across The Patch Of Sky You Draw As You Move It, Color In The Map With The Corresponding Colors.



UNIVERSE CUPCAKE RECIPE

Ingredients:

- Dark chocolate frosting (69% of total cupcake)*
 - Water: 25.7%
 - Cocoa Powder: 2.3%
 - Flour: 17.9%
 - Baking Soda: 0.5%
 - Salt: 0.2%
 - Baking Powder: 0.1%
 - Butter: 12.4%
 - Sugar: 27.3%
 - Eggs: 12.5%
 - Vanilla Extract: 0.3%
 - Instant Coffee: 0.8%
- Dark Chocolate Frosting (26.4%)*
 - Unsalted butter, softened: 27.5%
 - Vanilla Extract: 0.7%
 - Salt: 0.3%
 - Cocoa Powder: 2.6%
 - Powdered Sugar: 65.1%
 - Heavy Whipping Cream: 13.8%
- Sprinkles (4.6%)*
 - Sprinkles: 100%

* Measurements to preference

Directions

For cake batter:

- 1.) Find a cupcake tin that is large enough to hold the total contents of your cakes once it has risen. Prevent the batter from sticking to it.
- 2.) Heat oven.
- 3.) Combine cocoa powder and water at around 272K. Over time, the cocoa will be evenly dispersed through the water.
- 4.) The dry ingredients will be observably white when mixed together. The other ingredients when combine will hold a more spiral and peaked shape.
- 5.) When combined together they will create a dark, thick batter (not too thick).
- 6.) Pour into the cupcake tin and put in oven. At an internal temperature of 372K the cake will be completely uniform in texture.
- 7.) Remove from oven and allow to cool enough to not melt frosting.

For Frosting

- 1.) Cream together butter, vanilla and salt. Add the other ingredients. It should look dark and uniform.
- Combine appropriate amounts of cake (69%), frosting (26.4%) and sprinkle (4.6%).



RIPPLES
FROM A
HAZY
SOURCE



Frosting (26.4%)*
Butter softened: 27.5%
act: 0.7%

Flour: 26%
Sugar: 55.1%
Baking Powder: 13.8%

Sprinkles (4.6%)*
Sprinkles: 100%

*Measurements to preference

contents of your cake once it has risen.

Over time, the cocoa will be evenly dispersed throughout the cake. The other ingredients when combine will

thick batter (not too thick).

internal temperature of 372 K the cake will be completely

melt frosting

ingredients. It should look dark and uniform.
(26.4%) and sprinkles (4.6%)



BOLOMETER ANALOG

Materials:

- Germanium Lens
- Thin Plastic Shopping Bag
- Thermochromic Liquid Crystal
- Section of Acrylic Tube the Diameter of the Lens
- Black Spray Paint

Directions:

Stretch And Adhere Plastic Bag Over One
Opening of The Thin Acrylic Tube. Spray & Thin
Layer Of Paint Over The Plastic Film. Once
The Black Paint Layer Is Dry, Lightly Coat
The Film In The Liquid Crystal.



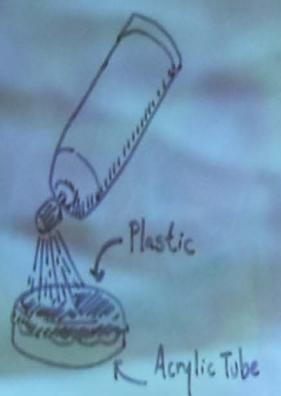
Attach Germanium lens To The CTH
Find A Patch Of Ground Outside
And Draw Out A Map Of It
The Space You Are Sitting In
Painted Side Is F

As You Move It, Color In The Map With It
Color On The Lens

ALOG

ag
Crystal
the Diameter of the Lens

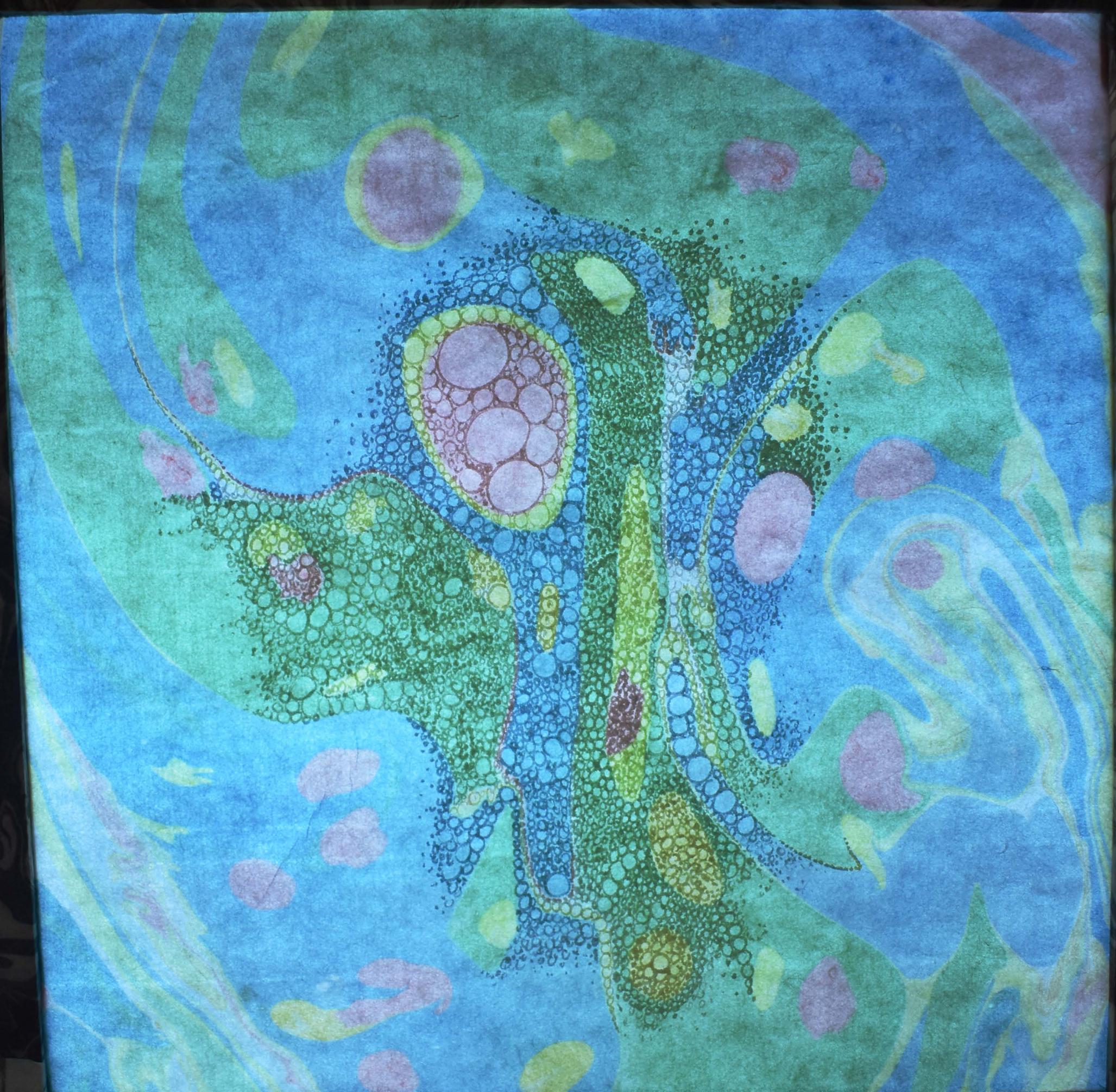
Adhere Plastic Bag Over One
in Acrylic Tube. Spray A Thin
Over The Plastic Film. Once
t Layer Is Dry, Lightly Coat
e Liquid Crystal.



ach Germanium Lens To The Other Side Of The Tube.

A Patch Of Ground Outside On A Clear Day

Draw Out A Map Of The Sky Immediately Above
ou Are Sitting. Hold Up The Lens So The Liquid Crystal
Is Facing You. Slowly Move It Across The Patch of sky
is You Are In The Map With The Corresponding



Credit: Z

