

# ASTC 2018 Live Demo Hour Demonstration

## Casey Carle's Soap Bubble Science or The Wonderful World of Trapped Gas!



### What did he do today at the live demo hour?

Used physics, chemistry and showmanship to create clever configurations from of the tri-molecular composition of multi-spectral, multi-dimensional, slightly irrational spherical liquids. OK...he made bubbles. As seen in his touring stage show *BubbleMania: Science, Art & Comedy!* Intricate fog-filled sculptures, choreographed bubble manipulations to jazz music and some funky soap film interplay utilizing The Hoberman Sphere. With explanations to some of the science behind the creativity.

### How can you do it, too?

It's a challenge to get soap bubbles to perform consistently on cue...and that's the reason there aren't a lot of full-time bubble performers. Basic knowledge of the physics and chemistry of soap film is important. But it's just as imperative to understand what affects soap bubble success beyond just having a great mix. I share a number of them with you here. (Bubbles are like working with animals: you have to know what they like and don't like...and then you have to clean up after them).

There are a lot of basic skill sets that can be learned quickly - even mastered in an hour or two - that can lead to using soap bubbles as endless, joy-filled, educational tools. There are plenty of online resources to help a newbie become an expert. This paper will get you started with a few of the elementary and intermediate steps.

## Bubble-Ology 201!

### Bubbling Formulas

Bubbles do not form in pure water on earth (the Space Station is another story!). Surfactants (Surface Acting Agents) are required to weaken the relatively strong surface tension of water in order to make it flexible without falling apart. Other ingredients help the soap film "self heal" under stress. The depth of bubble formulas and options have evolved immensely over the decades. Bubble pros and hobbyists (which include physicists, chemists and incredibly creative folk) have taken bubble science and art to levels considered impossible just a few decades ago. But science - as you know - makes the impossible possible! Specialized bubble making devices are required for the giant stuff but amazing manipulations can be done with the simplest tools.

But you still need to start with the right soap!!

Try starting with this basic formula that I share with my fans for a good home-made mix:

1/2 gallon (64 ounces) **distilled** water (tap water is usually not as good)

1 tablespoon Vegetable Glycerin (Can extend bubble life and stabilize colors)

14-16 ounces Ultra Dawn3X dish detergent (or 10-12 ounces non-ultra quality dish detergent).

**Ideally:** Search for Non-Ultra brands. Restaurant supply stores usually carry "Pro" Dawn or Joy. Get it if you can.

OPTIONAL: 16 ounces Commercial Bubble-Blowing Solution (Avoid "Miracle Bubbles" products, they are subpar)

OPTIONAL: For sculpture work: 2-4 more ounces dish detergent (but not more)

OPTIONAL: In very dry conditions: 1 more tablespoon of Glycerin (but not more)

Mix well. Avoid contaminants (see below). Keep in airtight container until ready to use. Long exposure to soap can damage grass. Avoid foam, which makes bubble-making more difficult.

For Hands-On Exhibits where you might go through many gallons and wish to avoid pricy commercial bubble mix OR you wish to use solutions with more advanced chemistry lessons tied to them, online searches will give you plenty of options.

The first and best place to start is here: [soapbubble.wikia.com/wiki/Recipes](http://soapbubble.wikia.com/wiki/Recipes)

Colleague Carl Nelson, Chief Scientist at The Imagination Station in Toledo, OH recently shared an excellent, inexpensive formula for the local ABC affiliate that uses guar gum and baking soda, along with the science of why each matters. Here's the link:  
[www.13abc.com/content/news/Imagine-It---Sept-1-2018---Super-Bubbles-492255301.html](http://www.13abc.com/content/news/Imagine-It---Sept-1-2018---Super-Bubbles-492255301.html)

## Materials

Nearly anything that can hold a soap film can be used to create bubbles. Some of the most intriguing tools come from nature (hollow dandelion stems, a bent green stick) or are everyday objects (shoelaces, pipe cleaners, jump ropes). Some of the most fascinating professional bubbling occurs using the simplest and cheapest of tools: wands, hoops, strings, tubes/straws and hands.

## Stop the Pop

Bubbles can usually be touched by wet things without popping. (Soapy wet even better). (Some micro-fibers and some natural materials like wool can often allow bubbles to settle or bounce off. There's a lot of science to that. Look it up!).

It's easy to hold bubbles on your wet hands (once the skin oil is diluted). There are dozens of neat hands-only tricks you can do, from holding and squeezing bubbles to separating one bubble into many. When making bubble sculpture, use a wet straw to blow different sized bubbles on a wet surface or in the air on a wet wand or hand. Blow bubbles inside another bubble with a wet tube. Quickly slide a soapy shoelace through a floating bubble to split it in two. Or have the bubble roll across the wet string. The possibilities are nearly endless. Keep anything dry away from the bubbles, including hair and sleeves.

## Wetter is Better

The water in the bubble is always drying up...but will dry up faster when the air is dry and/or bombarded with direct heat or intense sunlight. Choose shade when possible. Or bubble at sunrise and sunset. The diffused light also helps the the prism effect for seeing more visually intense colors. The higher the humidity the longer bubbles can stick around simply because evaporation is slowed down. Overcast, muggy or even misty days are great for bubbling. Avoid strong breezes that break up big bubbles. Warm air is not required. Bubble anytime it's at least 50°F with 50% humidity. *(You can freeze soap bubbles in temps of 5F or colder. Plenty of demonstration videos on youtube)*

## Love The Glove

Oil and water do not mix. So oil-free hands and tools matter. Insect repellent, hand creams and suntan lotions can react with bubble solution and cause poor performance. So can potato chip residue! I suggest cleaning hands before handling tools and certainly before dipping them in the mix. YOU can be your own worse enemy to the bubble mix. Wearing nitrile gloves keeps you from contaminating your own mix. And allows the same mix to perform better over more time. That is why I wear gloves in my presentations and workshops.

## Soap is Not Soap

The "soap" in soap bubbles is actually "detergent". The fundamental difference: soap is produced from natural ingredients, while detergents are made from synthetic sources. Detergents make great bubbles. Soaps will be highly detrimental to good bubbling. Example: Bubble bath is a detergent. If you introduce bar soap to a bathtub filled with bubbles they tend to go away very quickly. Keep non-detergent soaps away from your bubble stations and off your hands.

## New Toy? Oh Boy!

Silicone is particular damaging to bubble creation. And once introduced is hard to remove from containers. New plastic bubble toys often arrive covered in the silicon used to release them from their manufacturing molds. Always clean new bubble tools with hot, detergent water and rinse well before introducing them into your mixes.

## Foiled By Foam

Foamy build up on the surface of your bubble solutions will negatively effect size and consistency of your creations. It's one of the number one problems with large soap film exhibits at science centers. In those cases it's nearly impossible to stay on top of. But for any live presentations using soap bubbles, regularly remove the foam off the surface of the mix and from your tools.

## Mean Unseens

Very fine particles in the air can absorb moisture from the bubble, or interfere with the job of the surfactants. The bubbles seem to pop for “unseen” reasons. Avoid dusty or smokey environments. And aerosol sprays. Do not use old-style theater fog machines that use oil-based liquids. Newer models are glycol/glycerine-based.

Another unseen variable is pedestrian movement. As it moves through space the human body pushes air out of it's way. This disturbance can effect light weight soap bubbles a great deal. Intricate bubble sculptures in a busy walkway area will be pushed off the surface holding them. And big bubbles will be pushed into people and dry parts of the hoops, etc. When needed keep a “bubble buffer” zone of at least 6 feet from people movement.

## Cleaner Soap

It is important to keep your solution free of dirt, grass and debris. Inevitable when working with kids. Especially outdoors. Try not to add clean mix to the dirty mix. It's a quick fix but not as effective as using up the old solution, rinsing the container and starting fresh. Try adding a second clean source and compare the difference in performance.

## Fog It Up

In my presentation I used a fog making toy available online that was adapted/re-engineered to allow controlled movement of the fog. The methods I use are proprietary but you can find other methods described online. The best source for Fog/Vapor Toys: [www.zerotoys.com](http://www.zerotoys.com) (Note: I now avoid the term “vapor” for the same reason I have for decades avoided the term “smoke”: I prefer not to combine the healthy choice of bubbling with unhealthy habits).

## Who is Casey Carle? [www.Casey-Carle.com](http://www.Casey-Carle.com)

I was a math and science major in college, before stumbling into theater and getting fully hooked by it. Eventually launching a solo stage career with 300 shows a year annually in New England and with credits that include countless venues nationwide, a few international circuses, shows in 5 continents plus multiple TV and commercial spots. I've been a guest performer at over a dozen science centers nationwide. Many with repeat visits. Science continues to inspire me and I consider it a mission to inspire young people to see science as exciting, creative, fun and high on WOW factor. I live about 30 miles from our Hartford conference sight in the lovely woods of East Haddam. Hope you have enjoyed your visit to Connecticut!



## Online Resources:

### **[soapbubble.wikia.com](http://soapbubble.wikia.com)**

Soap Bubble Wiki is devoted to all aspects of creating soap bubbles. Whether it's mega amounts of small ones or creating beluga whale-sized bubbles with a “tri-string” device. This wiki is intended as a place for both beginners and experts. Beginners can find recipes and instructions for making the equipment required to do amazing bubble tricks, and experts can find out the latest bubble science and share their own knowledge with other bubble fanciers.

### **[Casey-Carle.com](http://Casey-Carle.com)**

### **[BubbleMania.com](http://BubbleMania.com)**

Try and copy the tricks in my videos and pics.

There is a Study Guide (co-authored by The Smithsonian Institute) here:

<http://www.bubblemania.com/science/studygd.html>

A STEAM approach that combines artistic curiosity and insightful scientific discovery with highly rewarding results.

## One-on-One Help?

Remember: I'm as much an advocate for science as I am for entertainment. And always open to answering questions that help you overcome common frustrations when using bubble-ology to educate, amaze and inspire. Please DO approach me at the conference or via email afterwards. We can dish science without once discussing my stage shows. I truly enjoy sharing my extensive knowledge of bubble-logy to help others further the use of STEM & STEAM to engage and grow curious minds.