

The Physics of Frisbee

.....by Katherine Keller

Frisbee is a relatively simple sport that anyone can learn with a little practice, and understanding just how a flying disc works will certainly give you the upper edge. The flight of a Frisbee is grounded in physics, and without it, no flying disc would go anywhere but down.

A flying disc lifts through the air when thrown due to the Bernoulli Principle, just like an airplane. Because of the curved topside of the flying disc and the angle with which it is thrown, air will move over the top faster than it moves under the bottom. According to the Bernoulli Principle, when a fluid's velocity increases, its pressure decreases. This means that there will be a pressure difference, with the lower pressure above the Frisbee causing it to rise. A flying disc is designed symmetrically so that this lifting occurs as close to the center as possible.

Without stability, air turbulence will cause a Frisbee to wobble and even flip over, quickly ending its flight. Angular momentum from spinning the Frisbee provides this vital element, just as it does with a gyroscope. Ultimately, it is all in wrist. A good flick of the wrist will supply the disc with the stability it needs for a smooth, straight flight. The thick rim of the flying disc, while also creating a nice handgrip, more importantly increases its angular momentum. The main point is that the more spin you put on the flying disc, the straighter and farther it will fly. Most flying discs, good ones at least, have ridges on the top, which create small amounts of turbulence. This turbulence is used to keep the air stream close to the top of the Frisbee and allows it to fly farther.

Of course, giving the Frisbee angular momentum will only cause it to spin in place. A forward momentum must also be given to the disc. The best way to achieve this is to ensure that the Frisbee is thrown as straight as possible so that it has a maximum forward velocity. I learned how to do this by standing sideways with the Frisbee in my forward hand and held level in front of the back half of my body. I then bring the Frisbee straight across my body as I throw it, flicking my wrist upon release. The spin will then keep the disc moving steadily until gravity pulls it to the ground. When a Frisbee either is caught or falls, you can see that it will still be spinning with nearly the same angular velocity it was thrown with.

By throwing a disc with a slight angle towards the ground, one can cause it to fly low and fast. A slight upward angle, on the other hand, will result in a high flying Frisbee that will tend to



stall in midair and drop straight down at the end of its flight. Under windy conditions, it is best to keep the flying disc low, where there is less wind. With a headwind, it will be difficult to throw the Frisbee very far and without a lot of extra spin, the disc will be highly unstable due to the increased speed of the disc relative to the air. With a tailwind, the disc will go farther but will also lose altitude quickly since the speed of the disc relative to the air will be reduced. These effects can be compensated for by adjusting the angle and amount of spin with which the disc is thrown.

Once you have the basics down, you can begin to experiment with some more difficult throws. One relatively easy trick is to throw the flying disc so that its outer edge is tilted upward. A Frisbee thrown this way will curve in the direction of the lower edge, enabling the thrower to make the disk arc around players between his or her target. A forehand throw is far more difficult and involves standing sideways again, but this time with the disc-holding hand in the back. The disc should be held just behind your back leg and released after a short quick movement just past your back leg. With this throw, the flick of the wrist is vital, and without a good spin, the Frisbee will flip over and never achieve a stable flight.

While you still may find that you aren't able to throw a Frisbee too well, at least now you can point out that you just aren't providing enough angular momentum or that the wind is too strong. In the end, the best way to learn how to implement your new found Frisbee knowledge is to practice. Happy Frisbee playing and good luck!

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who we are

UP is a monthly undergraduate physics newsletter sponsored by the University of Florida's chapter of the Society of Physics Students, for students, by students. We seek to strengthen the undergraduate physics community at the University of Florida by providing a forum for undergraduates to share their views and experiences with each other and acting as a source of information for opportunities and events in physics.

A friend asked how I was feeling earlier this evening, and I told her I was feeling violent. Right now I'm eyeing my glass of water with a heavy eye, and I want nothing more than to bike ten miles south and stone a lake to death. A kid drowned in it once, and it's a murderer, and murderers should be killed because that's what my mother tells me, and my mother lost a child once, so I can't be mean and disagree. She's too emotional for disagreements. So I nod my head, and I drink my orange juice, and I say, "Yes, mom, we should kill them all." And I am a good girl for not being mean. The plastic plants between us glare at me (all wax and shine, just like the real kind), and I'd be scared, but I'm a good girl so there's no point in scaredness, and we sit there, my mother and I, and drink orange juice and not talk, and we agree in silence.

So I'd bike to the lake and I'd stand there all night, towing and heaving until my muscles seized, and my legs gave out, and my squint-slit eyes drooped in an act of wishful thinking. I'd wake up, come morning, leaning against a tree, sticky socked with lake water, and with pine needles in my teeth, and spiders on my eyelids, and ants making a procession from my ankle to my crotch in search of higher ground.

Then I'd give birth to an ant baby.

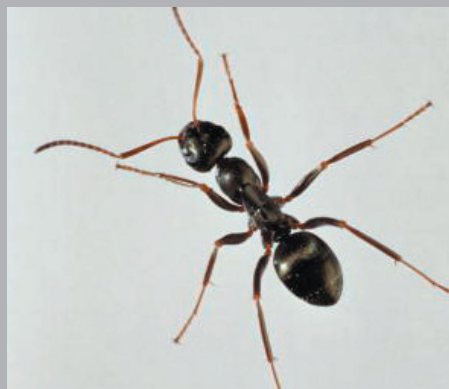
Mother says I shouldn't wear like boys. Mother says if I don't put panties I'll forget I'm a woman, but you can't forget you're woman when you've given birth to an ant baby and you've spiders on your eyelids and pine needles in your teeth.

I'd mother a dot, and I'd sit there and see it struggle and see it squirm and wriggle until it died from thirst or suffocation. Then I'd cry and mourn my little dead ant baby, and I'd smush it against my sticky sock until I could give it a

proper burial, because I wouldn't want to drown it in an empty lake, and because that's what mothers do - they bury their ant babies. The clouds would cock their eyebrows and call me a murderer, and I'd think about killing myself because murderers should be killed because that's what mom says every morning over orange juice and scrambled eggs and ants crawling over our sticky stove and splattered kind intentions. But in

Ant Baby

UP's first piece of artistic journalism



by Rahawa Haile

my town, and in my sky, a puzzled sun would rise and stretch its arms, and young 'round town kids would draw screwy pictures of a sun with many arms, and the Indian kids an ocean away would pray to the sun and confuse it for Shiva and get belted for blasphemy. But the sun would ignore them all and look at me, and look at the hole that used to be a lake and plead, "Where's my mirror, Lorraine? What've you done with my mirror?" And I'd smile from the knowledge that it's worrying and doubting it's shiny now that it can't see it for itself because I smashed its mirror and I smushed my ant baby and it's a good thing my ant baby's smushed against my sock 'cause it's too young to answer questions like "Where's my mirror." And things would be so-so for a time, but I'd soon go blind from laughing

wide-mouthed and full-bellied at a star going all hem, hem and a haw, and scratching its stubby chin, and Adam's apple doing up-down-up-downs from a bad case of confusion swallows. I'd stone a lake to death, and I'd drown all the mushroom and become the object squirrels glared at with venomous hatred while their acorns floated away.

It's not a good thing to do, to anger squirrels, but I'd do it anyway. And they couldn't hurt me because I'd just lost my child, and you can't be mean after something like that. I'd be too emotional. So they'd nod their heads, and they'd scamper past me, and hate me on the inside, and spell my name, 5000 feet high, in their tiny shit pellets. And it would take seven million of them, but they'd do it anyway, just to show what they really thought of me, but they'd never actually say anything because I'd just lost a child, and we'd drink up orange juice and agree I'm not so bad and we'd do so in silence. And I'd smile at the sun some more, and the sun would smile back because that's what it does -- it reflects. Then the moon would glare at it for stealing its job and having lost its mind. I'd bike back home, ten miles north, blind through traffic and alleyways, and I'd go to my dark, shuttered room, and I'd peel off my socks and hide under the covers and sleep. I'd close my eyes even though I didn't have to. I'd close my eyes because it's habit.

I'd awake groping the floor and looking for my socks, and when I found them I'd slide my fingers over the grooves, and I'd do so quickly, like I was the god of speed reading in Braille, until finally, I felt my little dead ant baby smushed against my sock. Then I'd cry, because that's what mothers do -- they stone lakes, and laugh at suns, and sit lake water socked, and mourn their little dead ant babies.

Brave Flowers Become Martyrs for Science

The SPS Homecoming Booth

..... by Sara Waters

Now, we'll get to the falling petals eventually but first, I'd like to introduce an interesting concept: A moonwalk. On Earth. Without any nose jobs involved. If it all sounds a little too hard to believe, or perhaps a little too good to be true, you probably didn't stop by the physics demonstration table during the homecoming parade on Friday, November 12. Who knew dipping a rather sizeable slab of copper into a container of liquid nitrogen would allow a strong permanent magnet to "moonwalk" down the cold slab when held at a steep enough angle? All right, maybe you did, but I certainly didn't. And neither did the children, students, and alumni watching the parade (well, not that they let on, at least).

Physics wasn't the only department with a club vying for spectators' attention. The brave SPS volunteers, Brad Barker, Layla Booshehri, Doug Sparks, and I, your narrator, were joined by Dr. Yoon Lee to demonstrate physical concepts while, less than fifteen feet away, the chemistry club attracted attention with bubbling blue and orange liquid and free turkey for all. Our neighboring table in the other direction, the zoology department, showcased small aquatic animals (including an especially timid blowfish). There were other departments out there, too, but their displays were less memorable.

Of course, moonwalking magnets weren't the only things that drew attention to our table. The container of liquid nitrogen actually served many purposes. By dipping inflated balloons into the container, we demonstrated how

gas becomes denser when cooled down; the balloon would shrink, only to expand again when taken out of the container and exposed to our warm Floridian autumn air. A tiny steam engine on the table whistled away when filled with liquid nitrogen. And no, no coals were needed since liquid nitrogen boils at room temperature and outside temperatures as well.

All right, I'll get to the flower deaths. Murder might be more accurate. Our table liked to involve the spectators in our demonstrations, and one way we did this was by handing out flowers that were then dipped into liquid nitrogen and were either smashed on the table or shattered in their palms. I know you're wondering, "What did these flowers ever do to them?"; but think about it, isn't death by exciting children and fellow students about physics a worthwhile way to go? The flowers certainly didn't complain. The people who visited the table seemed to enjoy the ruthless flower slaughter.

They also enjoyed experiencing firsthand the concept of angular momentum conservation after being asked to sit on a spinny chair and hold a rotating wheel. Move the axis of rotation and amazingly they moved, too! This may not seem like the most exciting concept to those of us who have taken a physics 1 class, but seeing the excitement in someone's eyes who has no previous knowledge of this conservative property is a great way to remind yourself why you decided to study physics to begin with: because, frankly, physics is cool stuff.



by Linda Watson

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Having brought you the scoop on the ice cream situation in Boston, I must let you in on the somewhat secret new ice cream shop right here in Gainesville. Sweet Dreams is a homemade ice cream shop, owned by a husband and wife trying to bring happiness to their customers through the glory of ice cream. I haven't found out their names yet, I'm ashamed to say, but they are incredibly kind and well-deserving of your business. For instance, I told them about my favorite flavor from Boston (Carrot Cake!) and they said they would try to make it for me. Let's see, some important information...

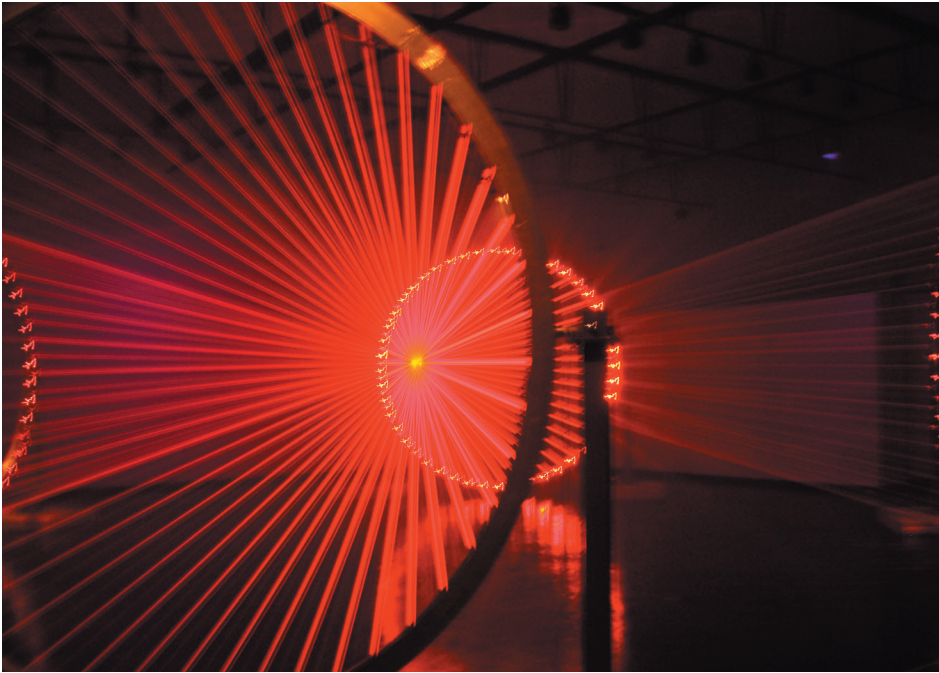
Where is it? So, I don't know the address, but I'll tell you what I tell everyone when I describe its location. It's on the Southwest corner of University and 34th, across 34th from Publix, in the shopping center with the Latin Café. It's between Goering's bookstore and Orion Fitness Center.

Most importantly, what are some flavors? Well, they rotate their flavors, so you can try a great variety if you visit them often. For instance, I've tried Coconut, Chocolate, Chocolate - Peanut butter, Bananas Foster, and Pumpkin Pie (mmmm, my favorite!). If those flavors don't strike your fancy, there are more to choose from and the quality of the ice cream is first rate. Sweet Dreams has two thumbs up from me!

'The Force' and Parallel Fields

An exhibit that crosses the bridge between art and science

by Erica Bolin



Many people view the gap between science and art a void that few dare to cross, or perhaps even think about; science is about cold hard facts and figures, art is about fickle emotions subject to change on a whim. Nothing could be farther from truth. I think the divide isn't so vast as one might think - visualize a river with science on one side and art on the other. While they are two distinct banks, the same water flows on their shores. Artist Matthew Schreiber crossed the length of this proverbial river with the opening of his exhibit titled "The Force" now installed at the University Gallery. Schreiber graduated from UF with a BFA in 1990. As a student, it was a physics class he took with Dr. Stanley Ballard that furthered his interest in light, physics, and the nature of vision. He began making holograms with Dr. Ballard and has since worked in several different media, often using science as his primary subject.

Schreiber gave a presentation at the November 8th SPS meeting. He showed a video of a 2003 installation he did celebrating Dr. James Watson and the 50th anniversary of the discovery of the DNA double helix. This displayed some of Schreiber's typical work using video holographs and other multimedia, including video and electronic music. The idea for his current exhibit, "The Force", is dramatically different. During the SPS meeting Schreiber elicited the help of physics students to help install the piece

which involved large concrete slabs, four metal rings eight feet in diameter, and lots of lasers. Not your typical sculpture.

Schreiber mentioned that many in the art world don't know how to react to science when he places it in the context of a gallery space. Judging by the reaction at the SPS meeting, I think the science world has similar hang-ups. The misconceptions of science as merely a process of uncovering facts leaves out the vast amount of creativity behind it. While I don't think anyone would blatantly deny the imagination physics requires, the subject doesn't seem to be confronted very often. Similarly, much of art requires the same attention to technique and skill that a researcher must have to study scientific phenomena, but because the outcome is not about the process, as in art, this is often overlooked.

The opening Friday, November 19th drew large crowds as it coincided with the College of Fine Arts' yearly open house, "Art Bash". Even though I had the opportunity to work on the installation early in the process, seeing the final product was astonishing. With the aid of both physics students and art students, Matthew Schreiber constructed two pieces over the course of eleven days. The main element dominates the room as over a hundred lasers point to one spot in the center of the space. The other, smaller piece located on the far side of the room is a nonfunctional Michelson

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interferometer. A fog generator is used to heighten the visual effect of the lasers.

The exhibit is on display through January 23, 2005 at the University Gallery, which is within the Fine Arts complex, just off 13th street. Hours are:

Tuesday 10am - 8pm

Wednesday - Friday 10am - 5pm

Sunday 1pm - 5pm

