UP undergraduate physics newsletter

Volume V, Issue #3, December 2007
UP News Online: http://www.phys.ufl.edu/~upnews

part 2 Physics Of Breakdancing

by Harold Rodriguez

CONTINUED FROM LAST ISSUE...

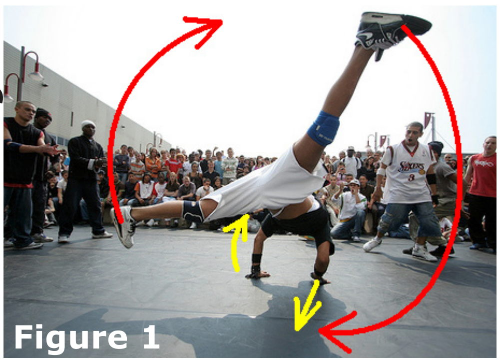


Figure 1

With legs apart, he will then **push** as hard as he can against the ground with his right hand. This will provide lift equal to, but hopefully much more than: *mg minus the upward force provided by his back-swinging left leg*. With this left hand, he adds a bit of extra lift, but more importantly, extra rotational inertia by pushing off at an angle. The breaker attempts to increase his rotational inertia by spreading his legs out as far as possible, as they naturally circulate around. If we let d be the distance between the breaker's legs while they are most apart, the breaker's rotational inertia will be given by, roughly: $I_{breaker} = (3/10\ m(d/2)^2)$ (assuming the breaker is a perfect cone, which most are).

If performed with great timing, the breaker will "pop" into the air. See [Figure 2]. Here, the breaker has nothing but the force of gravity acting, and thus cannot change his angular momentum. But just like a falling cat, there must be some way to turn over, despite having constant angular momentum. The trick lies in changing your rotational inertia (by changing the orientation of your limbs, etc.). Since angular momentum is constant, angular velocity must change correspondingly (since $L = \text{const} = I\ \omega$); thus, retracting limbs can allow the breaker to turn-over to an agreeable angle. In the best situation, however, the performer will have provided so much initial lift that he may "reach" across and land on his other hand. See [Figure 3]

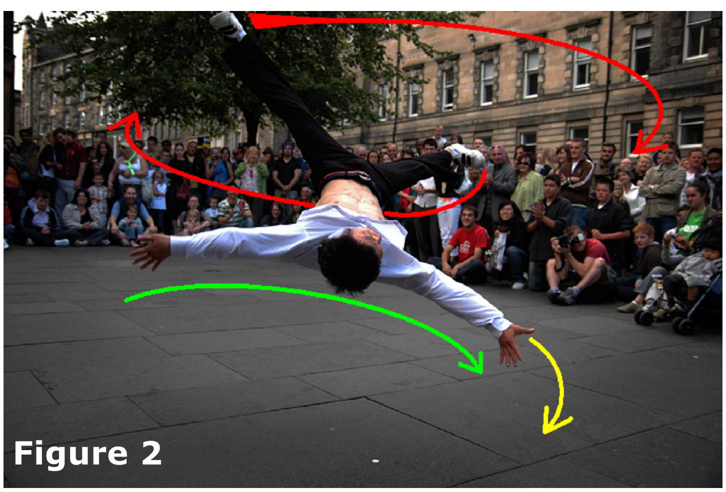


Figure 2

The breaker can only get to this stage if he recalls: "things that spin quickly and have large rotational inertia are hard to stop". The rotational inertia of his (presumably heavy and long) rising leg causes a net force upwards, while the other

CONTINUED *INSIDE*

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 to act as a source of information for opportunities and events in physics.

Visit Department
Coffee Time
Tuesdays & Wednesdays 3-3:45pm in NPB 2205
Professors, staff, and students are all invited!
Coffee, tea, hot cocoa, and cookies only 50 cents

what's UP
in this issue

BREAKDANCING *PART 2*

CONTINUED *FROM FRONT*

Figure 3

provides a horizontal twist. Let's assume the breaker remembered and got to this stage successfully; informally: hand = on floor. If one were David Griffiths, one would formally overanalyze this. Perhaps: if the integral over a closed Gaussian surface bounded by the skin of the breaker equals the enclosed quantity of the blood of the breaker:

$$\oint_{skin} \text{breaker} = \text{blood}_{enclosed}$$

the breaker has performed the move correctly (or at least hasn't bled all over the place).
Lastly, from here, the breaker must use the rotational inertia of his legs to propel himself into a position similar to that of [Figure 1], and then repeat the process ad pwndium.

REU ADVENTURES IN UTAH

by Larry Camarota

For his REU, Larry Camarota went to Brigham Young University. While there, Larry was able to climb mountains, visit Vegas, and, oh yeah, study stars. He applied to almost a dozen different programs during the months of December and January. He was accepted into the Brigham Young REU late in March.

While at BYU, Larry analyzed the cluster NGC7039 for variable stars. Variable stars are stars that have non-constant intensity. Most of these stars are variable because of the K mechanism (Helium ionizes. Ionized Helium is opaque. Light pressure causes stars to expand, cooling them enough for the Helium to de-ionize, and become transparent). The second most common type of variable star is the eclipser: when one star in a binary system passes in front of the other, the luminosity decreases for the period of the eclipse. Larry operated the BYU telescope to take pictures of many objects in the night sky. Additionally, he tested recently developed

Exploring Area 51

software which allowed him to quickly clean up and analyze large numbers of stars in a single frame (NGC7039 had over 300 visible stars per frame). He was able to develop some mathematical models to more accurately find multi-periodic variable stars.

Larry didn't spend all his time with his head in the stars. In Utah, there are a lot of mountains. Almost every weekend, the BYU REU program went on a hike up one of those mountains. He also went with some of his friends on an overnight trip to Las Vegas. The most interesting thing outside of the program, however, was the culture of Provo and Brigham Young University. A large majority of the people at Brigham Young are members of the church of Jesus Christ of Latter Day Saints (Mormon). The culture was a little strict on personal grooming, but over all, the atmosphere was nice.

REU ADVENTURES IN ITALY

by James Stankowicz

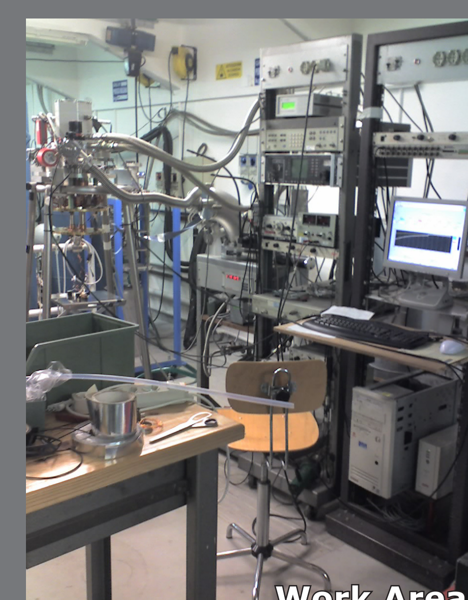
I spent the summer of 2007 working for the VIRGO project based in Italy, whose goal is to measure gravitational waves.

I first learned about the opportunity to 'Study Gravity Waves in Italy' (to quote the subject of the e-mail I received) from the Caltech LIGO REU program in February. By March I had applied. By April I was teaching myself Italian because I was going to Italy! The program ran in parallel to CalTech's LIGO REU program. In fact, I was in effect a LIGO REU student, which included the same living stipend. As I'd never before been out of the country, it took me some time to organize all the proper paperwork for a passport and a visa, but, by June, I was all set.

I worked for a group stationed at La Sapienza in the heart of Rome. Now no amount of audio tapes can possibly prepare you for the first time hearing and seeing a different language, and I very nearly lost my calm when I'd disembarked at Leonardo DaVinci - Rome's international airport. Fortunately though, English is the tourist's language, and, after navigating my way to the downtown train station, I was able to meet my mentor, and move my things into my apartment, which turned out to be a half hour's bus ride off campus (not at all an uncommon thing overseas, it turns out). It took me a couple of days to get fully adapted first to living in another country, and second to living in a big, big, big city. I had three other roommates, all graduate physics students, and each from a different country. We all spoke English (turns out English is not just the tourist's language but also the physicist's), and they played a big part in helping me adapt to the new style of life.

I spent my weekdays on the university campus, working on my research project. For newly beginning experiments it turns out there are normally quite a few bugs to work out, and mine was no exception. I certainly learned a good deal of physics, but my progress was slow, and I did not and could not do much for the benefit of VIRGO, although I undoubtedly laid foundations for the next person who takes up the project. I worked closely with the professors in my group, but, unlike what I'd imagine is the case in the US REU programs, I had very little interaction with other undergrads or grad students, and I expect that severely hindered my progress.

Corniglia (in Cinque Terre)

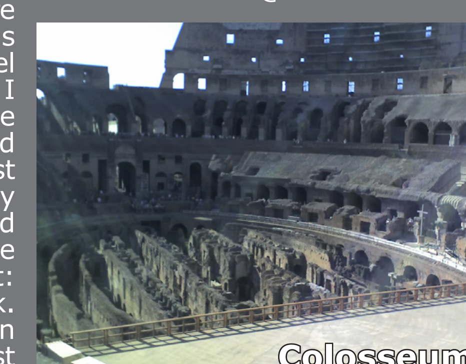


Work Area

I spent my weekends exploring Rome. I got to spend nine weeks meandering around a city in which many people consider themselves lucky to spend even a few days. This was far and away the most rewarding part of my experience. I dedicated a day to visiting, for instance, the Vatican, or the ruins of the Forum. It's worth saying, though, that such an experience would not be for the easily home-sickened because I knew no one in the country, and meeting new people on a limited understanding of the language was difficult at best – let's just say I now have a much deeper appreciation for Facebook.
I also spent a week in Pisa, where the actual VIRGO interferometer is located, so that I could get a feel for the overall project of which I was doing such a small part. While staying at a hotel in Pisa, I visited some of the cities in the northwest of the country, including what may remain, even if I visit a hundred other countries in my lifetime, one of my favorite places on the planet: the Cinque Terre national park. While in Pisa, I was hosted by an American physicist who had just received his PhD and was spending a year working at VIRGO – it was very cool to see first hand one possible path for a 'professional' physicist.

My REU was a fantastic experience. I learned first hand what it means to be one small cog in a huge, intricate physics experiment, which was something I'd heard, but never truly experienced before my REU. There was one point while I was visiting the interferometer that a conversation jumped from English to French to Italian and back to English – it was amazing to sense such community across national boundaries for a common purpose. Of course the fact that I got paid to spend ten weeks in the Eternal City, and the enthralling experience of learning a new language, culture, and way of life made my Research Opportunity truly incredible Experience. (I mean for that ending to be as cheesy as possible!)

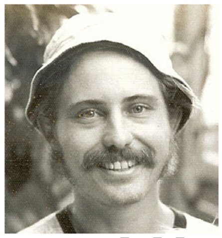
If anyone has any questions about the REU application process, or the program itself, feel free to e-mail me at OneStank@ufl.edu.



Colosseum

WITNESS TO THE "ADVENTURES OF A CURIOUS CHARACTER"

by Jonathan Young


Dr. Field

Just weeks ago, after being treated to a lecture by Feynman, physics majors at the university got as close as they probably have to knowing Feynman as a person. Florida's very own Rick Field worked with Feynman for a number of years as a research fellow and associate professor at Caltech in the 1970s. Recently, just before the Thanksgiving holiday, Professor Field gave a talk on how he met Feynman, the research he performed with him, and what it was like to work with the legend.

Dr. Field's journey began with his birth into a family immersed in the world of Hollywood. His mother and sister, Sally Field, were actresses. As Dr. Field would explain, his proximity to Hollywood would strangely enough play a role in shaping his relationship with Feynman. Professor Field's passion for physics was strengthened as a student at the University of California Berkeley, and he stayed on to receive a Ph.D. under J.D. Jackson (of Classical Electrodynamics fame). Dr. Field then moved onto a postdoctoral position at Brookhaven National Laboratory, where experimentalists involved him in the development of the parton model. A parton is part of a framework developed in order to understand hadron-hadron collisions and is the term given to high momentum quarks or gluons created in Quantum Chromodynamics hard scattering processes. As Dr. Field's work took him to Caltech, one day he gave a talk on his work with partons that was attended by Feynman and Murray Gell-Mann. At the time, Feynman was no longer working on high-energy physics; rather he had devoted his time to Egyptian hieroglyphics. Nonetheless, Dr. Field's talk caught Feynman's interest and soon enough, the two were the only ones left in the room still discussing partons. There, Feynman invited Dr. Field to visit him regularly to discuss physics. The Feynman-Field days had been born.

The collaboration between Feynman and Field led to a deeper understanding of jets, which are narrow cones of hadrons produced in high-energy particle collisions. It is interesting that although this body of work is collectively referred to as Feynman-Field, the original journal papers that were published listed Field as the first author. This was done at the insistence of Feynman, who felt that if Feynman's name was listed first, people would think the credit belong mostly to him. This was not the case – the way the papers were written went something like this: Dr. Field would write the entire paper, and Feynman would come in and pull out of his pocket folded-up slips of paper containing key notes that he wanted included in the paper. Their research ended up being highly productive and successful, with important applications to work done at Fermilab and even experiments to be performed at CERN.

Professor Field has felt that he was able to work with Feynman so closely due to an odd combination: J.D. Jackson and Hollywood. Dr. Field grew up amongst actors and actresses so he was never fazed by a person's fame or power. All too often, he would observe people who couldn't function around Feynman because they were so taken aback by his status. Dr. Field had no such qualms, and this, coupled with the thorough training he received under J.D. Jackson, allowed him to approach Feynman as if he were any other ordinary colleague. Their close working relationship shaped Professor Field's research, and it has been interesting to witness Feynman's legacy reach all the way to the University of Florida.

UP Staff

Editor-in-Chief
Larry Camarota

Layout Director
Erica Bolin

Online Editor
Harold Rodriguez

Production Manager
Alicia Swift

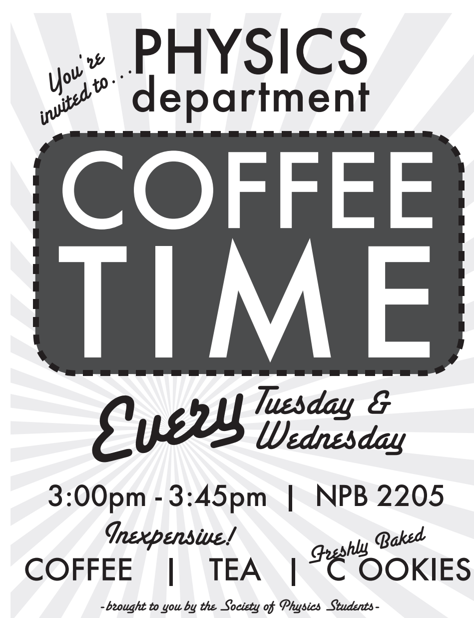
Assistant Editor
James Stankowicz

Staff Writers
Jonathan Young
Steven Hochman
Bryce Bolin
Miorel Palii
Stephanie Lewkowitz

Faculty Advisor
Dr. Yoonseok Lee

CALL FOR WRITERS

UPNews is always looking for undergraduates who want to contribute. If you'd like to get involved, e-mail us at upnews@phys.ufl.edu



Undergrads, Professors, Graduate Students and Staff are all invited to come! This is a great time to ask professors about research opportunities, chat about advising issues, or to ask lingering physics questions. With their blood sugar back up and their tummies happy, they'll be more likely to give you the nod.