AUSTIN HISTORY CENTER

Oral History Transcript

Interviewee: Harry Swinney

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Abstract: Born in Louisiana Dr. Harry Swinney grew up in Texas and Louisiana. After WWII the family moved to Austin Texas when the father attended the Presbyterian Seminary. Dr. Swinney's recollections of post war life in Austin are interesting. He graduated from high school in Louisiana, attended Rhodes College and was inspired by his physics professor. He went on to earn a PhD in physics. Dr. Swinney returned to Austin again in 1978 and embarked on a long productive career at UT researching such as: instabilities, chaos theory, collective behavior, the study of non-equilibrium systems, turbulence and vortices, science education programs, ocean energy and much more. He is retiring August 31, 2018.

HOBBS: *I am Colleen Hobbs and I am at the Austin History Center on August 23, 2018 and I am with UT physics professor Dr. Harry Swinney. Some of Dr. Swinney's titles are, the S.W. Richardson Foundation Regents Chair of Physics and the Director of the Center for Non-Linear Dynamics. And thank you so much for being with us today.*

SWINNEY: Sure

CH: *I was going to start by asking you about Opelousas Louisiana where you graduated from high school and then I realized I'd gotten ahead of myself because you went to school at Robert E. Lee Elementary. So, are you a native Austinite?*

HS: No, I was born in Opelousas. It's a small town near Lafayette. And for the next six years my father was a contractor, a small contractor. He moved dirt. He was in to dirt. He would get jobs that would be two or three months long to dig a drainage ditch or two or maybe to put down some dirt for a road bed. And we'd move to small town usually in Louisiana and sometimes in Mississippi. For six years we did that. He had a 1937 Ford Pickup and we'd put all our stuff in that Ford pickup. First thing that went in was my mom's piano which lacked the highest and lowest octaves. So, it would fit flat against the cab. We'd put that in first and tie it down and then we piled in the rest. A small number of things, a hot plate, I remember that. We'd move to the next town and get a little apartment somewhere and then we'd move again. Between jobs when he didn't have work he would often times go to a town, to bid on a job, "What jobs do you have to bid?" He once got a job that was a yearlong. That was a big job in duration. That was Crowley Louisiana. In 1945, the war ended of course. I never had a chance to really discuss what my father was thinking but he sold his business, his caterpillar tractors, which he was quite proud of. They were five of the first one-hundred made by the Caterpillar Company. And he sold them.

CH: *He was at the front of the line to get these then.*

HS: Yeh, this was early Thirties when he got them, when they first started making them. He sold them, and he had a drag line and he sold that. I used to go out on the job with him some. I loved it. He decided to go to Presbyterian Seminary, Austin Presbyterian Seminary and get a Bachelor's in Divinity and become a Minister. So, we loaded everything into the truck and came to Austin right when the war ended. He must have been planning this. I just know. I never had the conversation with him. But anyway, we got to Austin and they bought a house. They had some cash, so they bought on house on 44^{th} street east of Red River, 1017 East 44^{th}. I go by it frequently and it looks just the same, brick painted white, two bedroom…

CH: *The house is still there?*

HS: Yep it's in good shape. It sold recently. I know we bought it at a big price, it was seven thousand dollars. They paid seven thousand cash for it. And sold it later for seven thousand dollars. No appreciation, but maybe three years ago it sold for two-fifty (two hundred and fifty thousand dollars). I think it would sell for more than that now because of the location.

CH: *It has appreciated.*

HS: Because there's enough room you can build more. So, we lived there and that's when I went to Lee Elementary. That's how I started in Austin. After he graduated from seminary then he took some small churches in Louisiana. But I went through high school in Homer Louisiana which is a small-town north of Shreveport, near the Arkansas line. We lived there from 1950 to 1957.

CH: *But did you go through most of elementary school at Robert E. Lee?*

HS: I went through, that's a 3^{rd} grade report card!

CH: *This serious report card is from 3^{rd} grade.*

HS: I went through first, second and third grade. I entered first grade. First grade was somehow delayed. The war ended September 2^{nd}, I think, officially for the war with Japan. The war with Germany ended in May. Not clear on this but I remember starting October 1^{st} or something like that. Anyway, so I started first grade. I have memories of school but not entirely pleasant. I was small and, all through grades one through twelve grades, I was kind of bullied at times.

CH: *And you were in a new place*

HS: Well everyone was new to starting school. There was no Kindergarten in those days. That was before Kindergarten existed.

CH: *But you were new to Austin.*

HS: Yes, in that sense. But I think we were all new to starting school.

CH: *So, are there teachers that you remember? And from 44th street did you walk to school?*

HS: No, my Dad went to the seminary and he also took classes at UT in Greek and Hebrew I think. So, he was going past the elementary school to get to the seminary and he dropped me off. Somedays he would pick me up. But after I got used to the neighborhood I would walk home. I'd walk up Waller Creek and at that time where the HEB Hancock Center is now. That was another nine holes of the Hancock course. I'd walk through the creek and get into the Hancock course, and walk through the golf course then cross over Red River Street and walk through the golf course.

CH: *I'm thinking you lived not far from that HEB now. So, you realized that neighborhood developed. Well, could I get you to tell us a little bit about the Texas Roundup parade float that you talked to us about before? Now that we're recording…*

HS: So, each March UT held a Texas Roundup Parade.

CH: *For people from Louisiana this might have seemed like a new kind of holiday!*

HS: I don't remember that, but I do remember it seemed to me, for a second or third grader, to be a big thing! A big parade with bands and floats and lots of people along the side. I remember the mood being very positive. The war was over! My grandmother had a Victory Garden and she hated gardening. As soon as the war was over she didn't do that sort of thing. You know ration stamps for gas. I remember a party my parents had. I think it was October 1945. We hadn't had ice cream through the war. Because we didn't have sugar. You got a few ration stamps but precious little. They had an ice cream churn, the old style that you had to crank. It hadn't been used since before the war. So they invited some of their friends mostly from the seminary and some neighbors and had a big party. My mom made lots of custard to make ice-cream.

And they filled the annulus with ice and salt to cool it. And they cranked and cranked, and everybody was happy. They dished out the ice-cream and we all took a bite of the ice-cream and it was inedible. Because the can had holes in it from rusting through all those years. The salty ice water had gone into the ice cream.

CH: *I hope this was treated as a big joke and everyone laughed.*

HS: I think so.

CH: *It must have been a disappointment to not get the ice-cream.*

HS: It was memorable.

CH: *The house on 44th street, did it have a Victory Garden?*

HS: We moved there after the war. I don't know what they had there before. It had enough room in the back yard to have a garden. It had a septic tank.

CH: *Oh, it was that far out from the city, that it had a septic system.*

HS: But that changed while we were there, I guess. Or maybe it had already changed. I remember my father built a swing set for my brother and me. It was built over the septic tank, but the septic tank was slowly sinking. So, then they had to bring in dirt.

CH: *Septic fields will do that to you. You talked about your father moving dirt and building things. I'm interested in the fact that you came from a family of engineers. You mentioned the MIT talk that your grandfather…*

HS: Yes, my grandfather

CH: *And an uncle also was an engineer? And that you imagined you'd become an electrical engineer.*

HS: That's right.

CH: *So, can you talk a bit about how you made that change from engineering to physics and what its meant for you to have had one foot in engineering a little bit?*

HS: I did always plan to become an engineer. And I worked in the summers, when I was a teenager, for construction companies and for oil companies and oil fields. I would talk with this uncle who was an engineer. I went to Rhodes College. It was the only college that I applied to because of the suggestion of my family physician in Homer. He had gone to Rhodes College he said, and he'd had a great time there. He highly recommended it. "Why don't you go visit?" So, in my junior year in high school I went and visited.

CH: *You went to Memphis*

HS: Went to Memphis. My parents took me to Memphis. I visited for a couple of days and I really liked the feel of the place. I applied there, and I didn't apply anywhere else. My plan was to go there in their program which was called the 3-2 Engineering Program. Three years at Rhodes college and then you would transfer to Georgia Tech for two years and get an engineering degree from Georgia Tech and a bachelor of physics or bachelors of something from Rhodes College.

CH: *Two degrees in five years.*

HS: Yeh, two degrees seemed good. I took physics which I didn't have in high school. My high school didn't have physics class. I took physics and I really liked it. The professor was really dramatic and so enthusiastic about physics, Jack Taylor. After my first year, in my second year, I took two courses from Jack Taylor in physics. And I switched to a four years bachelor's program in physics from the engineering program.

CH: *So, it was really talents and gifts of this particular teacher that made the difference for you.*

HS: Yes, right and I maintained contact with him until he died about eight years ago. I'd go back and visit him every couple years. I still have contact with his wife. He was a wonderful guy.

CH: *Did you model any of the kinds of the work that you did then in your own class room.*

HS: I think the style that he had I have closely followed and that is, design an experiment and build some instrumentation. It was a small college. But he had a full-time machinist somehow in the Physics Department in the basement that would build all the equipment for the instructional labs but also for his research lab. And that's what I've done through the years. UT has a great machine shop in the Physics Department. And I've designed many pieces of equipment that were built in that shop. Some small things, one instrument took more than a year for more than one machinist to complete. It was pretty complicated, designed for conducting experiments with a particular goal in mind. Jack Taylor was interested in atmospheric absorption and solar corona. And we built, one summer, a science project. Another student and I built a heliostat to follow the sun. So, you could look at the sun all day with a spectrometer. But the sun would be stationary, following it with a moving mirror.

CH: *Sounds like you just described the importance of having infrastructure. Being able to build the thing that allows you to watch the sun all day. Are all physics departments in the basement? Are all physics departments dependent on important things that happen in the basement?*

HS: Right now, our department is recruiting a person from Princeton, a senior physicist. He would setup a laboratory and he wants it to be in the basement. Some of the basement rooms are not built on the foundation for the building but are connected directly to the bedrock, isolated from the building. So, you can do experiments that would not be disturbed by the vibrations of the building, people walking, or elevators going up and down. So, basements play an important role.

CH: *Ok basements are important. Now you came back to Austin after your getting your PhD at Johns Hopkins and teaching in New York for several years. So, could you flash forward from the Texas Independence Day Parades and your time being in Austin at that time, and when you came back thirty or so years later. What was Austin like in 1978 when you came back?*

HS: Of course, the skyline was entirely different. The Austin History Center I am sure has that well documented. Traffic wasn't nearly as bad; we lived in the Barton Hills area and could get to the university in under fifteen minutes. I don't remember backups on Lamar. I just drove into the university. There wasn't the sprawl outside of the city as well. And west campus which now has all of these apartment complexes that are fifteen or more stories high. There were none because there was the three-story limit on height of buildings.

CH: *Because of the code?*

HS: Yep, west campus looked completely different. So that's one reason the shuttle bus system is so extensive and goes down Riverside and goes far out in different directions.

CH: *Students had to live out there.*

HS: Right, I mean housing was just dispersed. It is much better for students to be near the campus. There's more campus life and interaction of work- play. I think that's a good move. It'd be better if the state would build more dormitories right on campus. But the state, well that will never happen.

CH: *Not for the next little while now so, I guess the city had changed significantly. It didn't feel like you were coming home to the place that seemed like home did it?*

HS: It some ways it did. My building's on 26th street, now Dean Keeton Street. When you look out north you see just a few blocks north, the Austin Presbyterian Seminary. I spent a lot of time on that campus, because I went there with my Dad. During the war the seminary nearly died. But my Dad came in with a class of returning servicemen and it was a big class. Suddenly they had this influx and they had a lot of infrastructure problems. The president David Stitt became a very close friend of my Dad for life and he had lots of problems to take care of course with the development of the seminary and the changes. He made my Dad sort of in charge of the physical plant in some sense, which my Dad loved.

CH: *He knew what to do.*

HS: He knew how to fix things. And I'd go with my Dad. So that is all very familiar and I go back there, and I walk through the seminary grounds sometimes. I see the chapel there and the library. Some buildings were torn down and new buildings built. But it does have a familiar feel.

CH: *You can see that from the forteenth floor.*

HS: Oh, another thing, that I remember from the 1940s which has changed. The northeast corner of Twenty-six street and Speedway. That is part of the UT campus now. There are three engineering buildings there.

CH: *Is it Petroleum Engineering?*

HS: Yes, Petroleum and Chemical and Mechanical and Materials Engineering are there. That was open area which had a circle of very small houses. It was called "The Leper Colony" and these were houses. I don't know if the seminary owned them. But these returning servicemen, some of whom were married and had families, lived in these little houses. I would play with their children there. It seemed like there was a playground in the center. These houses were very tiny, nine hundred square feet or something, I don't remember. But little houses built in a circle. Then when I came back to Austin, "Where's the Leper Colony? I can't quite remember where it was." Then I realized that's where these big engineering buildings are.

CH: *I wonder how it acquired that unfortunate name?*

HS: I don't have any idea about that.

CH: *But there are some very small houses just a little north of that. These were the forties version of tiny houses. I mean they were the original tiny houses.*

HS: They were small houses but as far as I know, people were happy to have them. And they were so convenient to the seminary. Families had one car or no car. You could just walk to the seminary and the university.

CH: *Yeh right there at twenty-sixth street. I had no idea what pre-dated the Petroleum Engineering Building and it was families.*

HS: And then beyond that was where the animal research center is.

CH: *Which direction?*

HS: On Speedway at twenty-seventh street. On the east side of twenty-seventh street is the Animal Resource Center where they keep the animals. No one knows and there are very few windows, so nobody looks in and there are no signs that says, "This is a building filled with animals".

CH: *I have never seen that sign. That's right and I won't see the sign.*

HS: Quite intentionally. That was the house, a nice big brick house, that was for the Dean of the seminary James I. McCord who also became a close friend of my Dad. I was awed by the man. We sometimes would eat at his house. He seemed to know everything. And he was known as a voracious reader. He'd go to bed and read a novel. He stayed at our house a few times when we lived in other places. He'd go to bed with a novel and he'd finish it. There's the legend. The proof, I don't know.

CH: *Ok, we don't know if he read all the pages. But he was at the end.*

HS: He went on to become President of Princeton Theological Seminary. And he won the Templeton Prize and various awards. He was a very robust heavy man. I can just see him. I was so impressed by him.

CH: *He must have had an air of gravitas or something.*

HS: He did, he could speak from the pulpit and it just seemed like the voice of God you know.

CH: *Gotcha, okay this is a question that might go back to your Rhodes College professor. I have seen you described as an experimentalist. Can you elaborate on what that description means? And I'll insert this, I had seen this video called "Saved by Inertia" which is where you lie under a slab of concrete and someone whacks you with a hammer. Does that have anything to do with being an experimentalist?*

HS: Uh that's a classroom demonstration which anybody might do. In physics, the practioners are divided into two groups. Those who have a laboratory are experimentalists and do experiments. They may do some paper and pencil calculations and they analyze data. And there are theorists like Steve Weinberg and many others who just use paper and pencil.

CH: *And their brains*

HS: And their brains, but there is this division. But now in recent years there is a third category of people who primarily use computers to do big calculations. So now it's sometimes said that Physics is built on a three-legged stool with computationalists, experimentalists and theorists. Now a theory is worth nothing until its proven to be true which requires experiments. And experiments are just a set of numbers until you give it some coherence and some generality through a theory, so they work together.

CH: *Now your particular field, and please excuse my over-simplification as I put this out there, your particular field is chaos theory which looks for patterns in unstable systems. And that's a very easy simple way to talk about that but you'll correct me. I am wondering if I can get you to talk about a few years back, you were looking at a flock of birds at Highland Mall that were spinning around over the Jack-In-The-Box before they rested in the trees. I wonder if you can tell a little bit about what those birds were doing and why you would be interested in what they were doing.*

HS: At that time, I was studying, among other things, bacteria in colonies and how they grow and the colonies form complex patterns. If you have a gel that is inoculated from a culture of the same bacteria with two inoculations, two points in which you begin a new colony of bacteria on a gel like Jell-O that has nutrient in it, bacteria can grow by eating the nutrients in the gel. What happens then bacteria colonies can be growing as a circular colony with huge numbers of bacteria. As they grow, how do the colonies interact? Actually, this led into some interesting discoveries we couldn't interpret. So, I teamed with a biologist, Shelly Payne, to see what was happening because of the behavior we saw: the bacteria were killing one another. And that seemed strange because these are brothers and sisters, cousins anyway. They came from the same original culture. Why were they killing one another? We couldn't find observations of that before. So, long story short, we discovered that they were generating a new protein that hadn't been observed before. And when you find a new protein you get to name it. So, we sat around, and all had ideas. But there are rules for naming proteins. Anyway, we ended up naming the protein "Sibling Lethal Factor", very descriptive.

CH: *Well that's just what you saw. I had seen that video and was amazed at how because you had colored them you could see the independent speeds of different groups.*

HS: So, the first interest was in the general colony behavior, the collective behavior of the bacteria in the colony. And that gets back to birds and the general interest in the collective behavior of people coming out of stadiums, exiting from the stadium, and zebra migrating in the Serengeti.

CH: *So, when we come out of the stadium we exhibit the same behaviors as the animals in the Serengeti?*

HS: Oh yeh it's very clear collective behavior. I mean people get into groups that are moving especially when you have crowds that are moving in counter directions. And they sort themselves out to get into groups that are going one direction to be separate from groups that are going in opposite directions, that's without thinking about it. Anyway, we studied the behavior of bacteria and characterized their motions and how they moved. They formed clusters and we found that if you have a small number of bacteria in a cluster it moves slowly but the more bacteria you have in the cluster the faster it moves. Oh that makes sense because if you get together as a group you can get to the nutrient source faster or you can escape a predator faster. So it's good to be in a group. We looked at that and saw a video on the BBC of flocking birds. And it described this study and certain properties of the flocking. Then we looked at the bacteria, inspired by that video, and found the behavior mathematically was like that of the birds in terms of their flocking behavior, which was completely a surprise. Because they are so different not only as organisms, but the birds move in three dimensions. They can move up above. The bacteria are only in two dimensions. Usually behavior of two dimensions and three dimensions is different. That's often a by-product of the kinds of experiments that we do --- we find different systems behave similarly. So, I'm looking for a trash bag…

CH: *I think I know what you're going to do. He's going to tear up the trash bag. He's tearing up your trash bag!*

HS: If you take a trash bag, which everybody has done. and tear it or take a cleaner bag or a zip lock bag or something that wraps your groceries from Central Market. If you tear it, you see that the edge is wrinkled here. And you know if you have a pencil that is one-dimensional. If you have the surface of this table, it is two-dimensional. And now if you look at this on a large scale you see there are waves in it. Now stretch it out and you can see there are waves in it. If you look on a smaller scale you can see there are waves within the waves. And if you look on a yet smaller scale you can see waves within waves within waves. And this project was started by one of the guys in my lab…

CH: *Did he tear up your trash bag?*

HS: He came in my office and did just what I did. And he said, "Do you understand?" and I said, "No I didn't understand that. Why don't we study it." So we did. Michael

Marder was an important part of this. Because he worked on the theory while we worked on the experiment. And that's the way it goes, somebody working on the theory inspired by the experiments and taking the results from the experiments and trying to understand them. So he saw this edge itself is not one dimensional. It's not two dimensional. But it has a dimension that's not an integer but 1.71. At the same time we were studying some other problems like electro-plating of metal. When you have electrolyte between two electrodes, one positive and one negative, you put a voltage across them and then you electro-plate the metal on one of the electrodes. Normally you want a nice smooth finish but if you increase the concentration of the electrolytes you get a growth which is very irregular. And it has this fractal property.

CH: *Looks a little like a snowflake.*

HS: Yes it does but the surprising thing is it had the same number 1.71 for the dimension of that fractal. And then we studied a number of other systems. We went to Central Market and got leafy green vegetables and found some just have flat leaves. But you take Kale and you look at its edge and it has waves. And in those waves, there are smaller waves and smaller waves just like analogous to those in this thin plastic sheet. We measured the dimension and it's 1.71.

CH: *So it's a number that is stable.*

HS: Right, and to this day that number is unexplained, there's got to be an underlying bigger theory that explains this phenomena. That's the kind of projects we work on. It's kind of a small-scale messy physics. It's not so attractive to most students. What's attractive are these big experiments like the one in Geneva, CERN, where they discovered this new particle which had been predicted fifty years ago, the Higgs boson. I have two colleagues who are continuing to work on that project. They are on the Atlas team that discovered the Higgs boson. They are two of the four thousand and some people who worked many years to find that particle. So that is one style of physics. In our style of physics you have one student working and maybe another student working on a similar project: a small group working on an everyday problem.

CH: *But you find these connections.*

HS: Looking for connections to understand nature. How does nature work? Personally that's much more satisfying. We have a new person who was just hired in the department and just arrived, who worked on this discovery of gravitational radiation predicted by Einstein one-hundred years ago. That was a magnificent discovery, it's wonderful, so exciting! Again it's a huge team where you have more than a thousand people working. In these groups in Astronomy, some of them have huge teams at different observatories, all focusing on some issue and working together as a team. A different style appropriate for the different problems.

STOP

CH: *Certainly, this might be a segue then. What you have described is people looking at smaller projects that have a bigger scope. And you also described the person who came to your office and ripped up your trash bag. And that says something about what the dynamics at Robert Lee Moore Hall and the way the people in your department interact. The people in your department work together on projects like this. When you came to Robert Lee Moore Hall early in 1978. Did that seem like a new building to you?*

HS: The building was what, eight years old or so. And there were people working in materials physics. The largest area of physics is materials physics, called condensed matter physics. Not knowing where to put me because I didn't fit into the usual sub-disciplines they connected me with the condensed matter physicists, which was fine. They were a very nice group of people. And within a year or so, I had recruited two of the faculty to form a little group, a research group. One was a theorist. And one was an experimentalist who was very good, Bill McCormick. The theorist was Jack Swift. So, we formed a group to study the kinds of problems that I study, non-equilibrium systems, systems driven in some way away from the simple state. Like when you have gas in a box that has walls at the same temperature you just have molecules that are bouncing around. You have gas with uniform density throughout. But if you start to heat the bottom and keep the top at the same or lower temperature you have heat flowing from the bottom to the top through the gas, right? Heat flows from hot to cold. If you increase that temperature difference, at some point, you begin to get motion of the fluid.

CH: *A convection…*

HS: convection exactly, we call the onset of convection an instability. As you impose a gradient on a system, here the gradient is temperature, at some point the behavior of the system changes. We're interested in systems of all kinds that are driven by the supply of energy by a gradient across the system. People eat, if we put you in a box with well-controlled temperature but you don't eat, then after a while, maybe a long while, you'll be a pool of chemicals. So you are maintained in a very elegant spatial form by the supply of energy that has driven your system to develop patterns, multiple patterns, often extraordinarily complex patterns. But we're interested in, how do these patterns form? And how do they become more complex and more complex and become a human-being ultimately?

CH: *Well it sounds to me like you were forming patterns when you came to RLM and you found people who were interested in studying the same kinds of things that you were studying.*

HS: Yeh, we had a lot of fun.

CH: *Sounds like it. Out of the like-minded people did that become the Center for Non-Linear Dynamics?*

HS: Yes, right. You know Michael Marder? He is the director of UTeach.

CH: *Yes, he came and spoke to the church.*

HS: Yes right, UTeach is a huge program that has been copied at forty-four universities. The University of California spent over a billion dollars to establish a replica of UTeach in the UC system. It's called CalTeach.

CH: *Had to rename it didn't they?*

HS: And the one in Kansas is UKanTeach and the one in Louisiana is GeauxTeach

CH: *Ok gotcha.*

HS: But he came. I recruited him, and he came to work as a theorist in our group. And he developed his own program but then he got me doing experiments to test some of his theoretical ideas. [deleted: that he developed. His initial program which continues to this day is, "How do things break?" How do you understand fracture of materials? And he is a world expert now in that subject. He had not studied that subject before he got to UT, but he identified it as an area in which was not understood. There was some ad hoc theory that had been developed over a number of years and made is possible to build planes like the Boeing 707 without their breaking. So, it was pretty sophisticated ad hoc theory, but he developed beyond that and then he developed a laboratory to do experiments. And then in 1997 the dean, Mary Ann Rankin asked him out of the blue to direct UTeach, and I have no idea how he was ever chosen. He had an interest in education. She and some others had a vision for new kind of teacher education, science education training which became UTeach.

CH: *He was so eloquent about public policy and the numbers from the state of Texas and where the state of Texas was in terms of education and where it needed to go. He was really erudite.*

HS: Oh yes.

CH: *Now you've touched on many of the things that I was going to raise up with you. And you've just mentioned practical applications. Because when we talk about the bacteria moving in different patterns that's one thing. But there you just mentioned your colleague who studies things breaking and that eventually helps one design an airplane.*

HS: Right.

CH: *I know that physicist aren't engineers and if you are looking at pure research you don't have your eye on the goal of practical applications, but I was just looking through some of the things that you had worked on and the stable vortex that you created mimics the vortex of Jupiter? Can you tell us why Jupiter's dot is red?*

HS: So that was observed in 1664 by Robert Hooke. A journal article states that on May 9, 1664, Hooke looked through his telescope and saw this great red spot on Jupiter. And he followed it through the night and he could see it was rotating. He determined from that the period of rotation of Jupiter is ten hours. And he was very close to the right value. But why is that spot still there? There's lots of big vortex flows in the atmospheres of planets and stars. We have a high-pressure system that's a big vortex, and similarly low-pressure systems. A hurricane is a more intense vortex. These systems emerge as a consequence of the earth's rotation. The earth's surface is heated so hot air rises each day from lakes and the ground and gives a flow which becomes turbulent. You get organization of these flows into big patterns like low-pressure systems and high-pressure systems. They generally last a few days. The longest, say a low-pressure or high-pressure system, will last three weeks maybe. But this red spot on Jupiter has been there for more than three centuries. And the question is, "How can a rotating spot be sustained? What's the mechanism that sustains it, this single identifiable spot." I [deleted: we] talked about that with a colleague who is at Berkley and who had been at MIT when I met him. I was giving some lectures there in 1981. I met his graduate student and we talked about working on some projects together, which we did. But then in '85, I started talking with him about this red spot of Jupiter. We talked by phone. It was before the internet, but we were just getting electronic mail because there were services through IBM and through the Department of Defense. Anyway, I went out to Berkeley after communicating several times. Then in the summer, we were in Europe; he was doing something, and I was doing something else. But we agreed to meet in London and spend a few days thinking about how we could design a model that he could compute and do some theory and we could do complementary experiments. We came up with some ideas about building a tank, "Now how big a tank?" One meter or two meters? Or how thick or how high should it be? Or how fast should it rotate?" And lots of details that we had to argue through and design. Every choice of a number was a compromise. You want it to rotate very fast but then it will fall apart. You want it to be very deep because you have friction at the bottom surface and top surface. You want that friction to play a minor role as it does in Jupiter because it doesn't have those surfaces. So, we came up with four ingredients that we really had to set in a way that would give the optimal conditions for observing this. And we built the tank. And we observed the spot, the formation of this persistent spot. Now if we'd rotate faster or if we change parameters we could get multiple spots that would form and then die like a high-pressure system dies. We could also get something like the jet stream. The earth's jet stream has typically, if you look from the pole, roughly three lobes. Sometimes it has two lobes. It rotates, and it moves with respect to the earth's surface.

CH: *But you found the condition in which that it stays the same…*

HS: We found a range of conditions. So, it's not critical that the conditions are exactly the same, but to have a range of conditions in which you get a vortex that lives indefinitely in time, a persistent spot like Jupiter's red spot. And we took pictures of it by putting particles in the fluid. We also took dye that would get trapped in the vortex and you could see it. One of those pictures appeared on the front page of the New York Times. That was the only time we got on the Times front page. We've had a number of articles on inside pages of the New York Times…

CH: *But you made the cover.*

HS: Made the cover of the New York Times.

CH: *So the things that are coming out of your labs and the things that came out of conversations with your colleagues are things that are used by people studying, well by NASA.*

HS: Yes, it was 1987, 1988 and 1989 that we did those experiments. Just one side note, we continued for a number of years until 2002 or so with students doing different experiments. And we found some things, some phenomena that gave [insight to phenomena of the earth's atmosphere. Then I was moving on and doing other things. And the tank, the whole system, the tank and rotating camera overhead controls and stuff had been sitting there. And recently I was cleaning out my lab now since I've announced I am retiring August 31st. And equipment is going to go to UT surplus and sell for 10 cents on a pound or something. So, I contacted each student and post-doc who had used that system and said, "Would you have any interest in this system?" One wrote back, the others wrote back as well and said, "No". But one wrote back and said, "Yes, I am at the University of South Florida in St. Petersburg, and four [marine science] colleagues and I are studying some phenomena. This tank would be great to use with our students." So he came just last week and rented a U-Haul truck. We filled the U-Haul truck with all the pieces. Now to get permission from the University of Texas system to move this, instead of it going to surplus, to move it to Florida required many requests and was denied many times. Then the person who was in charge of making a decision retired or resigned and a new person came in. I got the letter signed and it is out there. Let the equipment be used!

It just made no sense to not. I've given away a lot of equipment. I've gotten approvals for sending equipment to New York and Oregon and Georgia Tech and NYU and so forth.

CH: *But the piece of equipment that helped you study the red dot of Jupiter is now going to Florida.*

HS: Yes, I've got a picture in my cellphone of it in Florida.

CH: *Okay you should send us that! We can add that to your file. I've got just a couple other things. I don't want to take up too much of your time. I just have a couple of other things I'd like to touch on. Because you were talking about experiments that get done and very physical things in a lab and you have a project for hands on research in developing countries. Your projects, I think, takes very bare bones labs and teaches people how to do very serious science in those places.*

HS: You can do very serious experiments these days with instruments that are widely available and cheap. The cellphone is an example, and very cheap basic computers that sell for fifteen or twenty dollars. They're a board that you have to connect up. You can buy motors to control things or make them move.

CH: *I can't even imagine the kinds of things that people have been able to do in that environment. But because we talked about Michael Marder and we talked about U-Teach a little bit, I wonder if you ever thought about how could we take this model? How could the state of Texas use this model?*

HS: Let me describe the "Hands-On School" just a bit. I was on a committee, a national committee of the society of American physicists, its Committee on International Scientific Affairs. The committee promotes interaction with other countries, usually western Europe or China, Japan or Korea. But there was a sentiment in the committee that we should be doing something for developing countries. This was 2000 to 2003 when I was on that committee. I was the only one that did small experiments. All the other [inserted: other] committee members were connected with big laboratories like CERN or billion-dollar telescopes or fusion reactors like the international fusion project in France that's now going to be a twenty-billion-dollar project that will operate in the 2020s. But the committee's idea was to somehow involve scientists from developing countries in these big projects. And they came up with an idea that this large laboratory in Germany was closing, and it had some accelerator that could be used in a developing country as a light source for experiments studying materials. Well that's a fine scientific project, but I thought it was inappropriate as it cost millions and millions of dollars and it would be run by engineers. The scientist would come and get the data, but they wouldn't be involved in actually designing experiments. It was a mega-project that's finally just coming into operation in Jordan, and it's cost thirty million dollars at this point.

CH: *The German equipment is in Jordan.*

HS: Yep, it was reconstructed and repurposed in a way, to study materials instead of particle interactions. So that's when the idea of the Hands-On Schools came to my mind. If you want to do something for developing countries, you have very cheap computers, webcams, very cheap, ten-dollar webcams -- you can take so much quantitative information, a million pixels of a webcam, each one of which has new information many times a second. There's an enormous amount of information there. You can study heart rate. You can study moving systems. That style of table-top experiment is inexpensive, and its implementation can be used both in instruction and potentially in research in developing countries, particularly in instruction. The schools in Africa have almost no equipment, but they teach theory at a pretty high level. In an engineering school the students may they have no experience with equipment, and then the students go into the field. So, I talked with a friend, Kenneth Showalter from the University of West Virginia, who had very similar ideas. And we talked with another colleague, Rajarshi Roy up in Maryland. We wrote a proposal that we sent to the Ford Foundation. And we sent it to Rockefeller Foundation and to the National Science Foundation, the Organization of American States, the Dell Foundation. And we got a letter back from the Dell Foundation, "It sounds like an interesting idea and we wish you the best of success. But our foundation is focused on K-12." Okay, but we got No's from everybody. I had some connection with this international center for education that focuses on getting scientists from developing and developed countries together for programs. Trieste is the location of this International Centre For Theoretical Physics, which is really all sciences now, and it is operated by UNESCO. In 2006, I made an appointment with the director when I was in Europe for another reason. And I met with the director and made the pitch. And they agreed to sponsor three schools for three successive years. And we just got word that our Hands-On School is funded through 2022. And it's no longer just an external program where you get the imprimatur of UNESCO but you don't get very much funding. Now the bulk of the funding comes from UNESCO.

CH: *Now UNESCO's on board?*

HS: Yes, right.

CH: *I must say Harry that the thing that you have described, doing very serious science with available materials on a budget. That sounds like something you might have learned watching people operate caterpillar tractors and operating the physical plant at the Presbyterian Seminary. That's in your wheelhouse Harry!*

HS: My brother moved here not long ago from Houston after he worked at Exxon accounting for forty years. And we hadn't been interacting much through the past years. We are politically at opposite poles. But we started talking about our father and then about ourselves. We still operate very much like our Dad. And we can see it in my brother's son, how he is very meticulous, and he plans things and he builds things.

CH: *You were learning that when you were packing up that 1937 pickup truck to get your mother's piano to fit, you had to do it just so. Now here's my last question for you. Now you've watched your department change and you found like-minded folks to do kinds of projects that are interesting to you. If you could put one more project together, independent of the things that you've talked about. Is there one last question that you would like to find an answer to? Or one last thing you'd like to observe?*

HS: It's hard to limit it to one. But this property of fractal systems, fractal property of diverse systems that comes up with this number of 1.71. Yet to understand that…

CH: *you'd like to chase that one down, that number…*

HS: Yes, another question which we haven't discussed which we've been studying for a decade, is related to climate. And that number, that goes in predicting the climate, is the amount of energy in the ocean. The amount of energy in the ocean is not well known, there are large uncertainties. I heard a talk about that ten years ago at UT by a PhD graduate in physics who was working at the Woods Hole Oceanographic Institution, and he came back to visit his PhD advisor and visit Austin. He gave a seminar in the department “What can you do with a physics PhD? You study the oceans” for example. And then we chatted afterwards, and I showed him our experiments. He told me, “Why don’t you come visit us at Woods Hole and we’ll chat up there?” So I went up to Woods Hole and talked to, it’s a huge operation and government funded institution. I visited people in engineering and physical oceanography and so forth. And that was that. A year later I hadn’t heard from him. I just had this nice visit. And then he called and said, “Harry we just put together a proposal, with investigators from ten institutions, that’s a response to a call from the government for a study of some oceanographic features. That’s to be a multiple university research initiative. And we’ve got nine, would you like to be the tenth?” He says, “We’ve got it all written but you need to supply a paragraph.”

CH: *Think you could do that?*

HS: I was thinking of retiring the next year or two at that point. That was about eight years ago.

CH: *So, did you write the paragraph?*

HS: So I wrote the paragraph and then didn’t hear anything for eight months or a year. And I got a letter, “So we got this multi-million-dollar grant, but you got a small piece, a hundred fifty thousand a year for six years.” Six years, well ok, I decided to focus on this open question: “how much energy is there in the ocean?”, a question about which I knew nothing. But I had been doing some experiments and nibbling at it. It turned out to be, not surprisingly or somebody would have already answered the question precisely, it turned out to be very complicated. But we’ve been making progress.

CH: *So you are working on climate change.*

HS: It’s related to climate change, right. And we are very pleased to have a paper with a theoretical physicist whom you probably wouldn’t know, Phil Morrison. But perhaps you know Laura.

CH: *Laura Morrison?*

HS: Laura Morrison is running for mayor.

CH: *Okay now I’m with you*

HS: His wife, but Phil and I have worked for thirty years off and on. He is very theoretical, more so than Michael Marder. But he is brilliant in knowing how to take different mathematical equations or ideas and put them together. We just finished a paper the day before yesterday. It's a small piece but it's the next piece in answering the question. It's an enabler piece in that we have a method developed theoretically by him and his student and an experimental component and computational component developed in my laboratory, that is, with students and postdocs, one of whom is now at Northeastern as a professor. But it all came together. And it's on how energy or power measurements can now be made in the ocean with a much simpler technique. There really was no technique for determining that energy in the ocean. This is not a simple technique, but it is well prescribed technique for addressing that question.

CH: *Harry you don't sound like someone who's going to retire on August 31st. You don't sound like coming to closure there.*

HS: I have some projects but they'll either be published or just dropped at some point. But I won't have a laboratory. That's a huge difference for me. There's a meeting this afternoon with the associate dean and three faculty about how they are going to remodel my two laboratory rooms, one is fifteen hundred square feet and one is seven-hundred and fifty square feet. Each of which will be emptied. One I've completely emptied, and the other I am in the process of emptying and giving away equipment here and there.

CH: *Sending it away to Florida.*

HS: So, we're meeting this afternoon to decide what renovations will be done and who will use that space. So, I am through ["out of" replaced by "through"] doing the kind of experiments that I've done. But I have some data from older experiments and I have some people that I've been working with on certain ideas so there will be some papers.

CH: *I think you've kept your hand in a couple of games there. I don't think you are completely out of it.*

HS: I'm interested in doing more community activities. My good friend Curt Wyman is very active in Austin Interfaith and he was an engineer for forty years and I have other friends who are retiring or are retired.

CH: *So Austin will be the recipient of some of your spare time? Curt's done so much work in getting students to UT from his high school and the high school where he teaches.*

HS: Wonderful job there after he retired from Motorola, went through UTeach and then taught.

CH: *Well I think I've come to the end of the things that I had to talk about. If there's something I've forgotten or something you would like to put into the record. Then this is your opportunity. The history center is so fortunate to be able to be able to have this little time capsule from you.*

HS: I love Austin and I can see the attractiveness is helping the university now in recruitment. Austin was just another place twenty or thirty years ago. But now Austin has an international reputation. When we recruit that really helps our department.

CH: *So you've seen the difference during your time at the university.*

HS: Yes and I am optimistic about the future of UT as an attractive place for faculty. It's a huge place. You can find people with all kinds of specializations. And the administration, particularly the new dean of the college of sciences, is very supportive of collaborations between different departments. The barriers between departments are historic. Engineering was separated from physics in the nineteenth century. And then the engineering disciplines were setup with the civil and the mechanical and electrical. That's all nineteenth century, biomedical is recent. But the barriers between departments and the significant barrier between engineering school and the college of sciences are easier to surmount this days.

CH: *From your own experience you can see how those boundaries are fluid between engineering…*

HS: Yes, they're not set up so much for scientific reasons. It's often for administrative reasons. And so, I look forward to interacting with grandchildren. Our grandson went with us as you know to Italy.

CH: *I was always charmed by that your grandson was going to Robert E. Lee well which is now Lee…*

HS: Russell Lee

CH: *Russell Lee, the name has changed although the school is the same. That's some continuity.*

HS: Yes, oh and there's another continuity in that my grandparents, the Swinney's, had two children each of whom had two children. At this point there's no great grandchildren, of my grandparents, with the last name of Swinney. But now my nephew, my brother's son, his wife is expecting a boy in just two weeks or so, maybe just one week. I just got an email from them and it could be this Saturday or something! So it would be the first Swinney born in a long time. So the Swinney name may live from that. And Swinney is very uncommon.

CH: *I did not know that.*

HS: Sweeney, S-w-e-e-n-e-y is a common name, an Irish name or Scotch Irish. But as far as we can tell when our ancestors came from Ireland and they came to Ellis Island and they gave their name Sweeney. But they were illiterate. And it was written down as Swinney.

CH: *Okay, so that name was given to you.*

HS: That name was given to us with a different spelling. And when I lived in New York City and had the big Manhattan phone directory, I looked to see Swinney and we were the only Swinney's. That's pretty rare!

CH: *What are the chances of that?*

HS: Now there's a football coach in South Carolina, Dabo Swinney, that's been in the news.

CH: *Maybe his name got changed at Ellis Island too.*

HS: Well it could be that we're related. We're talking, my ancestor came in the 1750s or something really. So, I don't know. But it is very nice in science to have a name which is rare -- if you just type in my name in Google or in search engines. But if you look up a paper by someone by the name of Smith or even worse Zhang, the most common name in the world, and I've had a couple students named Zhang, you just can't find their work.

Because if you look in an abstracting services, ISI Web of Science or Google Scholar or something you can't find their work.

CH: *There you are apart from the pack Harry. Thanks to Ellis Island.*

HS: Right thanks to ignorance in the past.

CH: *Well this has been a delight and I thank you so much for making time.*

HS: Oh it's a pleasure. It's fun. I recalled things that were back in my memory, like I said, Hilda Gail Walker's name.

CH: *Hilda Gail Walker who was with you in the Texas Roundup Parade in 1940 what year?*

HS: I am not sure, 1946 or 1947.

CH: *Well if Hilda Gail Walker wants to Google her name she'll be able to find herself in your oral history. Well thank you.*

HS: Sure it's a pleasure.

Transcription completed by Lori Duran on September 14, 2018