AN INTERVIEW WITH THOMAS P. ARMSTRONG

Interviewer: Jewell Willhite

Oral History Project

Endacott Society

University of Kansas

THOMAS P. ARMSTRONG

B.S., Physics, University of Kansas, 1962

M.S., Physics and Astronomy, University of Iowa, 1964

Ph.D., Physics and Astronomy, University of Iowa, 1966

Service at the University of Kansas

First came to the University of Kansas in 1968

Assistant Professor, 1968

Associate Professor, 1970

Professor, 1975

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Q: I am speaking with Thomas P. Armstrong, who retired in 2003 as professor of Physics and Astronomy at the University of Kansas. We are in Lawrence, Kansas, on August 19, 2003. Where were you born and in what year?

A: Atchison, Kansas, in 1941.

Q: What were your parents' names?

A: Floyd Armstrong and Mary Armstrong. They were a farm family in Atchison County.

Q: What was your parents' educational background?

A: My mother had a teaching certificate earned at a school in Atchison. She had taught some grade school. My father had a high school education and a short course at K-State and had been farming ever since.

Q: Did you have brothers and sisters?

A: Yes, a brother Paul, now deceased, who farmed in Atchison County, and a sister, who survives and recently retired as a nursing supervisor at Atchison Memorial Hospital.

Q: You grew up in the Atchison area then, is that right?

A: You bet.

Q: Where did you attend elementary school?

A; Elementary school was a little one-room country school house called Shannon Hill. It is long since out of business and consolidated out of existence. I was in a school with eight grades in one room. I had a marvelous teacher, who I fondly remember to this day.

Q: How many pupils was she teaching in eight grades?

A: We had as few as five or six and as many as 15 or 16. This was a school area made up of a region about three miles by three miles.

Q: About what people could walk, I suppose.

A: I think that is the way it got organized.

Q: Did you think the education was pretty good there? Some people have fond memories of this kind of schooling.

A: The advantage I had, of course, was a very understanding and sincere teacher. My first grade teacher was a woman who was also my cousin. Then in subsequent years a woman had that school who was quite a strong teacher. She completed her career as superintendent of schools for all of Atchison County. Getty Repstein was her name. She was really marvelous. The advantage to me was, it being one room, after I completed my grade level work, I was able to listen to the lessons and participate in the work of grades ahead of me. In fact, I spent only seven years there doing eight grades. Then I went to Atchison High School.

Q: Were you in 4-H?

A: Oh, sure. I did all of the country kid things, including tending my father's dairy herd in the evening. It fell to me to milk these cows, so I did that after school. I didn't participate in high school athletics for lack of the time to do so. But I did debate.

Q: Were you interested in the stars and planets as a child?

A: Growing up in that part of Kansas at that time one could almost not avoid dealing with the night sky.

Q: You can see so much better in the country, can't you?

A: The sky was dark. We enjoyed that. I had always had a science inclination. I was the youngest of three kids. I often got left behind to tend the chores around the farm. As such, I would find machines to take apart and things to experiment with. So I was a mechanically inquisitive kid and liked all kinds of science-related stuff.

Q: Then you went to Atchison High School.

A: Yes, I went four years there and ended up accepting a scholarship to the University of Kansas from the Atchison County Alumni Association, thank you very much. I also was at a scholarship hall at the University of Kansas.

Q: Did you have influential teachers in high school?

A: Of course. Probably one of greatest consequence was Miss Randolf, the English teacher. She had senior English. There were math and science teachers who did interesting things, but I most remember this English teacher and how oriented she was to getting people ready for college.

Q: Did you have honors in high school?

A: Oh, sure. There were two or three of us who were straight As or nearly straight As in high school. That was the cohort who I spend a lot of time with.

Q: Then in the summers you worked on your father's dairy farm.

A: Absolutely, year around. That was not an option. It was a necessity.

Q: When did you graduate from high school?

A: I graduated from high school in 1958 and went directly to KU in the fall. I was here at KU from 1958 to 1962 and graduated with a bachelor of science in physics. At that point I went to Iowa for graduate school.

Q: Now when you were at KU your major was physics and you lived in a scholarship hall.

A: Battenfeld.

Q: This is one where you do some of your own work.

A: Absolutely. I enjoyed it very much. I was proctor there my senior year.

Q: I suppose you majored in physics because you had always liked science.

A: I had always liked science. In fact, the only B I got in high school was in physics. I couldn't let that rest, so I decided to major in physics here.

Q: Was there any connection to astronomy here at that time?

A: Some, although I really didn't pay that much attention to astronomy. Of course, about the time I graduated was the Russian launch of Sputnik I. I was very much impressed with the opportunities for science and technical work and have stayed in it ever since.

Q: Yes, that was emphasized a lot at that time, as I recall.

A: I was a Sputnik brat.

Q: Did you have influential teachers from your undergraduate days at KU?

A: Most certainly. My advisor was a brilliant man, Arnold Straussenberg. He advised the honor students in physics and astronomy at KU. One of the folks who I most admired for his teaching style, what he did and how he did it, was Bob Stump, who was still on the faculty when I came back to join the faculty. Bob

and Jean have retired some time ago. In fact, they are doing quite nicely now at Woods Hole there in Massachusetts on Cape Cod.

Q: I imagine that KU and Lawrence both were quite a bit different in that time than they are now.

A: Dramatically so. The old Dynamite was still on 23rd Street.

Q; What was that?

A: That was a dance hall and eating establishment that stood on ground approximately where Wendy's is now. Business establishments were quite different. The early drive through restaurant was the Big Buy at 23rd and Iowa. It stood where Furr's Cafeteria was located. The establishments up and down Massachusetts were quite a bit different. Of course Ernst Hardware was always there.

Q: I think Weaver's probably was.

A: Absolutely.

Q: About everything else has changed, hasn't it?

A: The Lawrence National Bank building has changed in recent years at 7th and Mass. The Eldridge Hotel was there.

Q: That's right. Did you say you graduated in 1962 as an undergraduate?

A: Yes.

Q: Were you ever in the military?

A: No. I was about a year ahead of the curve, so to speak. I graduated from high school and started to KU when I was 16. So during the time I turned 18 and had to register for the draft, I was on student deferment. Then I went to graduate

school in physics and astronomy at the University of Iowa. So I was student deferred. At the same time I married a scholarship hall woman, a KU grad. My wife Jeanette accounts for a major, major degree of what I've accomplished. So we went off to Iowa.

Q: What was her field?

A: She was in nutrition and dietetics.

Q: Where did she come from?

A: She was an Emporia girl.

Q: How did you happen to choose the University of Iowa?

A: We both got support there to do graduate work.

Q: Oh, she was doing graduate work too.

A: She went to graduate school there as well and got a master's in nutrition and dietetics. She was grinding up rat brains while I was writing up data and listening to the beeps and squawks from outer space.

Q: So you got into astronomy as a master's student.

A: I went into space physics with Professor Van Allen and joined the cohort of people then enrolling at Iowa who account for a substantial fraction now of all the space physics that is done in this country and worldwide, for that matter. So that was a very fortunate choice. It was a nice match for what I was interested in doing and capable of doing.

Q: I suppose you wrote a dissertation as a master's student.

A: I wrote a master's thesis on earth track radiation recently discovered by Van Allen and some of the characteristics of it. Professor Van Allen directed with a great

amount of patience and red marks on the work. The perspective on graduate research at that time—I was very eager to get on with business and I didn't want to spend years and years in graduate school. I wanted to go through fairly expeditiously, if I could. In space physics in those years students were involved in building experiments for launch into space.

Q: Was this the government that was launching things?

A: This was early NASA and the Office of Naval Research. They were sponsoring the building of various satellites. I was involved heavily with Professor Van Allen's group. I saw several significant launch failures and what it did to the graduate degree work of others and the delays that it caused. So I chose to do a numerical modeling, sort of a theory and numerical simulation type project with a new faculty person, David Montgomery, who had just joined the faculty at Iowa. I've never regretted that either. I basically did that on the side while building instruments for Professor Van Allen and carrying them around the country. I learned how to do stuff with computers.

Q: They would have been fairly new.

A: This is when computers were large and antiquated. At the time, my dissertation work for about three or four months consumed about 20 percent of all the computing at the University of Iowa at the time. A respectable lap top would put it to shame these days.

Q: These were punch cards, I suppose.

A: Of course. These were old programs. I still have some of the punch cards for souvenirs. I solved some equations that hadn't been handled the way I did it and

was able to establish the validity of one of the fundamental calculations in plasma physics to the satisfaction of Professor Montgomery and others. I took a degree in 1966 in four years.

Q: In 1966 was that your Ph.D.?

A: Right. The master's was in 1964, the Ph.D. in 1966.

Q: That is really a short time.

A: I was a laggard because there was another student in my cohort who did it in three years.

Q: Did you write a separate dissertation for your Ph.D.?

A: Absolutely.

Q: What was that?

A: That was on the numerical solution of the Lazoff equation. It was an early numerical solution. Dave Montgomery was sort of a knowledge expert on the analytical side of that. I taught myself how to do the numerical work.

Q: Then after you received your Ph.D., what did you do?

A: I stayed at Iowa for a year and did post doc work with Professor Van Allen and wrote a proposal with another graduate student for an experiment on a satellite called the Interplanetary Monitoring Platform, IMP. It was successful. I competed successfully for launch on a NASA spacecraft. There were actually two launches, IMP 7 and IMP 8. I am pleased to report that IMP 8 works to this day.

Q: You mean it is still up there?

A: It is still up there yielding data. It has gotten so old and so obsolete that it was too costly for NASA to continue to operate it. So they asked us to figure out a different way to process the tracking data from this thing. And we've done it here in the business you are presently sitting in. A graduate student of mine, Jerry Manwiler, is the co-owner of this business. He and some others have basically rebuilt the ground part of the data processing of this ancient satellite. Our Australian friends in Canborra track it. They put the result of the tracking on a computer in Canborra, Australia. We have programs that wake up in the middle of the night and inquire with this other computer whether anything has been recently added. If so, we move it across and process it.

Q: What sort of data are you trying to get, what's going on with the satellite?

A: This satellite is instrumented to measure the effects of the sun and solar flares on the radiation environment of the earth. We've been measuring the big solar events. We are almost through the third solar cycle now. IMP 7 was launched in 1972. IMP 8 was launched in 1973, each for a two-year mission. And they've lasted. In the case of IMP 8 we are still operating it. It will have its 30th anniversary this October.

Q: Are these fairly big things?

A: About the size of a garbage can. They are each a circular cylinder that is covered with solar cells. When the sun shines on it, it broadcasts. When the sun doesn't shine on it, it doesn't broadcast. When it broadcasts, it sends this data out. Some of it falls on the ground and some of it falls on our antennas. We listen to it and make sense of it. So we have the world's longest by far data set, which is a direct

measurement of the energy input to the upper atmosphere of the earth, as people talk about trying to understand global change and why our atmosphere changes.

Q: You mean like global warming?

A: Global warming and changes in ozone, changes in atmospheric chemistry and all of that. A lot of that begins in the upper atmosphere with the impact of this solar charge particle radiation on the atmosphere. So we keep track of that. We publish the data. We generally try to understand how one solar cycle changes differently from another. Maybe we will be able to understand what are the generalizations that one can make about what the sun really does, what it produces. So that is a major ingredient. In fact, I proposed that before I was even a faculty member. We started writing the proposal when I was a graduate student. We just sort of slipped one in. And we got funded. To this day it's been 30 some odd years of a nice experiment. It happened also as a young faculty, early in the game here, I took a sabbatical semester to go back to the applied physics laboratory where my cohort, who I co-proposed with on IMP 8, was.

Q: Was that at Iowa?

A: While we were both at Iowa we wrote this proposal. And then he went to Johns Hopkins Applied Physics Laboratory and I came to KU, after a short stint with the controlled fusion people in Europe. I did controlled fusion work in England in 1967 and 1968.

Q: Oh, you lived in England.

A: That's where we went after Iowa and then came here. From 1968 forward my entire academic career was at KU.

Q: How did you happen to come to Kansas?

A: By accident. It happened that on the way out of the country I came through Atchison and thought I would stop by the physics department here at KU for a social call and did so. They had changed the department administration and had hired a space physics guy to be chair, who was the only space physics person around and I knew him. I had met him when he visited at Iowa. David Beard and another faculty person, Paul Goldhammer, and I went out to lunch. When it came time that my post doc was completed in England, I wrote to various folks in this country asking, "Do you know of any good leads for a permanent job?" I wrote to David Beard and he said, "One of my astronomers just quit suddenly. Would you like to come and spend a little time in the physics department?" The other offers I had at that time were temporary, at NYU and UCLA. So I came to KU. It was a remarkably positive thing for me, mainly because I had just enough mentoring from Professor Beard to be helpful and not so much that I was inhibited from doing what I needed to do to conduct a program here to do space physics work.

Q: The year you came back to KU was what?

A: 1968.

Q: That was a time when there was a lot going on in Lawrence, wasn't it?

A: Yes. I entered the scene at an interesting time. At various times we were standing watch over the computers and gear in the physics department. I witnessed a lot of the rabble rousing meetings on the lawn of Strong Hall. I was

totally uninterested in anything other than the kind of work I needed to do to earn tenure.

Q: I imagine your students probably weren't very involved in the rabble rousing either.

A: There were almost no graduate students in physics, or for that matter undergraduates, who had the time to do antiwar demonstrations and the like.

Q: What building was physics in then?

A: Malotte Hall, and to this day it still is.

Q: Who was the chairman?

A: The chairman was Professor Beard, followed by Professor Davidson, followed by Professor Ammar and that's it.

Q: While you have been at KU, have your research interests continued to be involved with space, satellites and things like that?

A: Precisely, space physics. At the moment I am involved with Voyager and Galileo and Ulysses, Casini, Advanced Composition Explorer, IMP 8. We are trying for some other projects that seem needed involved with aerospace engineering folks, at this point trying to develop a way to revisit some of the old problems I began my career with in the close earth environment. We want to go back and answer some old longstanding questions that we have.

Q: What are some of the things that your experiments are studying now on some of the satellites?

A: Probably the most interesting and exciting thing that has just happened, or at least we believe happened with Voyager I in the last half of 2002, is that for about six

months Voyager I was totally outside the sun's influence. This means that it would have been for the first time in human existence an object outside of what we call the heliosphere, where we are surrounded by the effects of the sun's atmosphere. So Voyager I is at 85 earth-sun distances. It is 85 times the earth's distance from the sun.

Q: That is hard to imagine such great distances, at least for me.

A: We are still communicating with it and still reducing the data from it. That data indicates that it is quite different in the last six months of 2002. The characteristics of the solar radiation that we have known and loved for the last 30 some years changed.

Q: Because the satellite went farther away?

A: Because it went beyond what we call the termination shot, the closest thing to a boundary that we are going to see that defines the difference between the solar system and the interstellar median. So that's probably in recent months the most consequential thing that has happened. We have done a lot of other things that are of greater interest to specialists. But when one tells the general population that we have an object here that we can prove has finally left the solar system, that's a first. It never happened before. So we will continue to examine the data from Voyager I very closely. The other thing that I am proud about in my career is all the students who have come and gone and where they are and what they are doing, their accomplishments.

Q: What courses have you taught here at KU?

A: I have taught astronomy and taught physics, elementary and advanced and most recently computational physics. I introduced the computational physics course at KU. I introduced the space physics course at KU. For a good many years I taught an environmental physics class, although I should still be teaching it with what is happening in the world now. There are a lot of things we should be taking a different approach to.

Q: Do you mean like the ozone layer?

A: The ozone layer and global warming and energy conservation and some common sense kinds of things. If we weren't so wasteful as a civilization, we'd be a lot better off. I think of the heritage of both my wife and myself, where everything is reused and recycled. Really, nothing was wasted. In my mother's case she was from an immigrant family, Swiss German immigrants, who were from a tradition where one made one's own soap, one butchered one's own meat and canned one's own vegetables. These were independent people, interested in getting the most out of everything.

Q: You said you had had this one sabbatical. Have you had other sabbaticals?

A: Yes. I had taken a sabbatical on two occasions to the Applied Physics Laboratory in Maryland. On one sabbatical I stayed here in town and worked along the same lines. I spent two years on leave at NASA headquarters in 1989.

Q: Was that in Houston?

A: This was in Washington. I was there to work on administration of research, the federal programs that sponsor research in space physics.

Q: When was that?

A: That was in 1989 and 1990.

Q: I suppose you have had publications?

A: Yes, mostly in the scientific journals, not so much textbook-length things.

Q: I wondered if you had written any books?

A: No books, but lots and lots of papers, probably 150 papers. I've got two or three in the air right now. There are always a couple of things that are being reviewed.

Q: You've been on university committees, I suppose. Any particular ones you remember?

A: Sadly, I must confess that I have done committee service. The most useful one by far was the University Research Committee, the Faculty-Senate Research Committee. I did a lot of work on that in the 1980s and early 1990s. The other committee of consequence is faculty evaluation for the department.

Q: Have you had administrative positions with the department?

A: No.

Q: You were talking about the fact that your students were a big part of your career here. Any particular ones you remember who have gone on to greater things?

A: Really all of them. In total, I've trained about 27 or 28 Ph.D.s

Q: That's a lot.

A: And perhaps 10 master's students, give or take a few. In one way or another, they have all accomplished a lot. My very first student is now a fellow of the American Physical Society. My most recent student is a faculty member at Johnson County Community College. One of my students is a faculty member at the Citadel. Another student is a senior scientific staff at Johns Hopkins. Several

have gone back abroad and are teaching, one in a program in Pakistan, where he is not permitted to travel any more. I'm pleased to say through the good graces of the lady next door a little symposium has been organized and these folks are going to get a chance to gather back together September 13. I've got to be real careful so that it is not a memorial symposium. I've got to watch how I drive and how I behave. There will be a meeting.

Q; That should be very interesting.

Q: I'm interested because I couldn't be more pleased with the fact that people would give up a little bit of time and some effort in coming back. In fact, it is going to be a science meeting all day, a Saturday science meeting to talk about this kind of stuff .

Q: Do you have children?

A: Two.

Q: What are their names?

A; One is here in town. He has a two-year degree from Pittsburg State and is in the trades, a technical guy, a welder. He's got a couple of kids who stay with us, the whole lot of them. So we have a full house. My daughter is an academic sociologist.

Q: What are their names?

A: Elizabeth is the girl and Stewart is my son.

Q: I think she may have known my son, Ben.

A: Oh, yes. They were in the same cohort going through Lawrence High. She is now teaching sociology. It falls to her to explain sexual behavior to these sweet

young freshmen at Indiana. She does a course somewhat similar to the Dennis Daily course. But it is more to explain and understand the unusual and different sexual behaviors that one finds in society. She has one son. She married another academic sociologist, who happens to be making his way now as a software engineer. She did a dissertation on the organizational sociology of gay and lesbian groups in the Bay area of San Francisco. Anyway, they are breathtakingly different people.

Q: Have you had this company here for a long time?

A: The company has been in existence since 1997 and has been located here since 1998.

Q: What does your company do?

A: The same thing I have always done. Basically, we do all sorts of fancy data services for NASA. We are proposing for small business initiatives and earning our living here as a technology company doing services for various people.

Q: Have you been involved in professional organizations?

A: The American Geophysical Union, to some extent. I am not a big time organizing person. I have organized a couple of conferences and that's about it.

Q: So you haven't held offices in this then?

A: No.

Q: Have you been involved in community activities?

A: Almost not at all.

Q: Do you have continued involvement with KU?

A: I hope to extend it some. I am sitting on student exams. I am teaching a seminar for the aerospace folks this fall. Steve Sanders is the new chair of the Physics Department, and he's got a nice detector development lab and we've got some ideas we want to try out in instrumentation for fancy detectors. We'll try to make some new products for market and do some new sciences. We think that Steve will be able to help us and his lab will certainly be very valuable. So we are trying to put together a deal where we can find a sponsor in the federal government who will help us bring some stuff into existence that we haven't had before.

Q: You said you have been on phased retirement for about five years. Is that so that you can concentrate on this business?

A: As it happened, it was an option available and I was interested in trying out some private business initiatives. It worked out very nicely.

Q: Did you teach one semester a year?

A: One semester on and one semester off. Phased retirement can be any negotiated reduction that one wants. Most people go fifty-fifty. That makes it easier to be there one semester and be away one semester. I've taught one semester a year for five years.

Q: Do you have other plans for retirement in addition to this business?

A: This business is quite enough for right now.

Q: Did we mention the name of it?

A: Fundamental Technologies. We've got another initiative starting up that's (unclear). We started Lawrence Networks. That serves small offices, small

business computer repair networking, sort of custom installation, various software products and equipment. Then we have going forward a new initiative, A3RD. It stands for Advanced Analog Research and Development. This is based on some intellectual properties and inventions that another Ph.D. student of mine made, Dr. Alexen Keen. He has patented and proprietary ways to do instruments a whole lot better than they have ever been done before, everything from small gadgets that get implanted in your body to things that get flown in hostile places. Every time there is a sensor that captures a reading from some condition, temperature, pressure or something, that number needs to be interpreted and used. The step of interpretation and use requires electronics and certain things that are done to translate the physical effect, the sensory effect, into the desired action that is needed. So we are trying very diligently to develop this technology to the point where it can be included in ordinary things that people use every day, such as light switches that respond to your voice.

Q: They come up with new things all the time like that. I believe you said you have grandchildren.

A: There are two with us and Elizabeth has one in Bloomington.

Q; What is your assessment of the Physics and Astronomy Department or KU, past, present, hopes for the future, that kind of thing?

A: Fortunately, we are almost out of time. I have a telecom at three that I have to sign up for. I'm very pleased with everything the university has done for me. I believe that the department is in good hands with Professor Sanders. I should probably not say much more.

A: My pleasure.