The Photon: **Spotlight**

On Alumnus Scott T. Snell

Recollection of a Physics Major

My love of astronomy seems to have started early. My family tells me that I could see the sky from the window near my crib, and that my first word was "Moon." Books, "Star Trek," a telescope, and a subscription to "Sky and Telescope" nurtured my interest in the subject all the way to my freshman year at UM, when I chose astronomy as my major. Later, I switched to physics, with my second major in astronomy, in case I decided to attend graduate school.

Scott Snell in front of the Physics Building at the University of Maryland.

As important as astronomy is to me, I admit that my curiosity is, sadly, perhaps not as intense as it should be for those who work in the sciences. Instead, I remember my college days defined more by my competitive spirit responding to the difficulty of the course regimen. I worked hard to achieve, not only in my own major, but also in the rest of my courses. My advice to those with similar goals is to work very hard on homework problems and also use some of the study aids that are available commercially to strengthen your abilities. I noticed that many of my fellow students whose grades were lower than mine didn’t put as much time into their homework as I did.

Truth be told, I did not attend lectures often. I spent most of my time reading and rereading chapters or working problems. The textbooks we used seemed to be very thorough conceptually and generally didn’t need clarification, so I felt that my approach was the best use of my time and resources. Of all my lecturers, I remember Dr. Kacser most vividly. His presentations were often a swirling maelstrom of eccentric humor and digressional commentaries, from which emerged unique, clear, memorable, and very useful explanations that could make his classes sometimes uneven but usually worthwhile.

I also remember my physics lab courses with fondness. Drs. Richard, C. Y. Chang, C. C. Chang, Gloeckler, Fotouhi, and Matthews were my professors over the years. I became good friends with my usual lab partner, who was a very talented guy named Tim Warner. Our collaborations had a good mix of complementary talents, teamwork, individualism, idea volleys, humor, and a dash of rivalry here and there. We usually did our data analysis separately but

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Physics Alumni | UM Physics Research

On Spintronics

A new class of device based on the quantum of electron spin, rather than on charge, may yield the next generation of microelectronics

by Dr. Sankar Das Sarma
Physics Professor

Dr. Sankar Das Sarma serves as one of the Maryland Physics Department's Distinguished University Professors

The last half of the 20th century, it has been argued with considerable justification, could be called the microelectronics era. During that 50-year period, the world witnessed a revolution based on a digital logic of electrons.

From the earliest transistor to the remarkably powerful microprocessor in your desktop computer, most electronic devices have employed circuits that express data as binary digits, or bits—ones and zeroes represented by the existence or absence of electric charge. Furthermore, the communication between microelectronic devices occurs by the binary flow of electric charges.

The technologies that emerged from this simple logic have created a multi-trillion dollar per year global industry whose products are ubiquitous. Indeed, the relentless growth of microelectronics is often popularly summarized in Moore's Law, which holds that microprocessors will double in power every 18 months as electronic devices shrink and more logic is packed into every chip.

Yet even Moore's Law will run out. Click here for full story in Adobe PDF

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I recall helping each other out of some puzzling spots. It was the same with our homework. We both knew study groups that would have each person work a few problems and share the results with the rest of the group. But we both benefited from working all of the problems on our own and occasionally discussing some of the tougher ones.

I made an unusual extracurricular choice during my college years. I was so deeply immersed in my studies and the surrounding physics culture that I tried to find something different to do employment-wise. Rather than working as an intern in some physics-related job, I worked in a used-book store. After I graduated, my first employer in my career field noticed this and certainly didn't consider it a plus, but my grades and my interview were both big pluses for me, so I didn't regret my choice.

I passed an honors exam in my senior year. During this time I started leaning away from pursuing a graduate degree. My lack of enthusiasm towards conducting my own research was a major part of my decision. I began considering going after an MBA degree, or working at the Patent and Trademark Office, or in the defense industry. However, it was my friend Tim who reminded me that my true love was astronomy and the space program. Even though it paid less than some of my other options would, there really was no question what I should do. Tim was working for a contractor at NASA's Goddard Space Flight Center, and I started sending out résumés for openings there. My membership in the American Astronomical Society came in handy during my search. Their Job Register had a listing that caught my attention. The job was for a "Telescope Operator" for the International Ultraviolet Explorer satellite. The contractor was Computer Sciences Corporation.

The Mission Operations Center for Small Explorers is Scott Snell's new home at Goddard.

My decision, in retrospect, couldn't have been more right for me. My new job was to remotely control IUE from Goddard. The telescope wasn't a world-class instrument as far as light-collecting area goes; some amateurs' telescopes have larger mirrors. But its location in geosynchronous orbit allowed us to keep in constant contact with it from our ground station, and it was far above the obscuring layers of atmosphere that attenuate the ultraviolet light we sought. I was fully in my element, turning the spacecraft's telescope among the stars, identifying targets, pointing the spacecraft precisely, starting exposures, collecting the data on the ground, and getting the camera ready for future exposures.

Telescope operators had the opportunity to see the spectral data first, while performing quick-look analysis. All of us worked hard to get to the observer's targets as quickly as possible, learning complicated acquisition techniques and honing them. Planning ahead favored the skills of a chess player; having to work out the two-dimensional spatial problems of target acquisition and keeping cool under the pressure of unpredictable difficulties might favor a video-game player. I was one of a dozen or so people that did this, either from Goddard, or from our international partner's site near Madrid, Spain, where the European Space Agency operated IUE eight hours a day. I also got the chance to meet and work with astronomers from all over the world, who came to Goddard to observe with IUE or analyze data it had collected. Our group was tight-knit, almost family-like, with our common bond of the "bird" flying about 22,000 miles above South America.

IUE was one of the most productive science instruments ever created. (See Freeman Dyson's essay about it in his book, From Eros to Gaia.) But eventually funding for it dried up. I worked there for the last 5.5 years of its 17.5-year NASA science mission. (ESA continued the mission for one year after NASA pulled out.) I once had the chance to ask NASA Administrator Dan Goldin about the decision to end the mission. He replied that Mission Operations and Data Analysis [costs] were "eating us alive," so some of the operating spacecraft fleet would have to be switched off to free up funds for new missions. Unfortunately (from my perspective), there are no other spacecraft operated quite like IUE was. Most are nearly autonomous, thanks to an onboard computer, loaded daily with time-tagged batches of commands, rather than run entirely by the "real-time" commanding we did. After IUE ended, I looked at other opportunities within CSC, including employment with the Space Telescope Science Institute in Baltimore, and also a job at Goddard called "flight software engineering." I made my choice in the same way I'd chosen my major of physics. I took the one that seemed harder to excel in. It also had the benefit of working on multiple missions, which seemed prudent in a field where any one mission, even one as eminent as the Hubble Space Telescope, could suffer a catastrophic failure and end quickly. Since then, I've provided flight software support for CGRO, EUVE, UARS, and two of the Small Explorer series (TRACE and WIRE). Just as IUE was reprogrammed to control its attitude with two or fewer gyros, I now have the expertise to similarly reprogram spacecraft computers to handle a wide variety of user requests. Common requests are workarounds for failed spacecraft components, anomaly analysis and resolution, and expanded or revised spacecraft mission objectives. I shepherd my software patches from a requirements phase, through designing, coding, testing, and implementation. My spacecraft operations experience still comes in handy when implementing my computer programming changes. Last year, I was part of the team that successfully brought CGRO through a controlled reentry into the south

Pacific, avoiding potential dangers to life and property when this motorbus-sized spacecraft's mission ended. We recently won a Group Achievement Award from NASA for our work.

All these years after leaving the Department of Physics at Maryland, so much of what I worked so hard to learn there is only fragmentary now, some perhaps even outdated. But what sticks with me to this day are the rigorous problem-solving techniques I picked up in the Physics Department. I'm able to channel my obsessive tendencies into a productive avenue, thanks to that! And I've had occasion to use the statistical tools we picked up in the lab classes. For instance, the solid-state recorder aboard TRACE occasionally suffers large-scale data corruption. The cause, either hardware- or software-based, was unknown. My investigation indicated that the problem was starting exclusively in one segment of memory, and that this finding was highly significant statistically. Later examination of the memory schematic showed that this segment corresponded to a single module, a nearly conclusive correlation that indicated hardware was the root of our problem. (Unfortunately, we couldn't do much to remedy the situation, but at least we knew what the cause was.) Another case where statistical knowledge was helpful was during a study I conducted of the long-term performance of the calibration and camera-preparation lamps onboard IUE.

I keep busy when I'm not at work. For example, I serve on the board of directors of the National Capital Area Skeptics, a local organization that advocates the use of science and reason as the best ways to understand the world around us.

The flight software team that I'm part of is a varied group. Many have computer science degrees, but one has a PhD in astronomy, another is a mathematician, and a number of other physical sciences and engineering fields are represented as well. The key elements of this group are problem-solving abilities, capacity for learning and extrapolating from complicated and abstract source material regarding various spacecraft subsystems (some of which is incompletely documented), and succeeding where little or no formal training for the task at hand is available. The details of my job now are quite different from what I immersed myself in many years ago in the Physics Department at Maryland. But I've never forgotten that it's there where I first packed my toolkit and built my mental muscles for the job I'm working at today.

• See Scott's profile

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