# Remembering Steve Rallis

Jim Cogdell and Dihua Jiang, Coordinating Editors
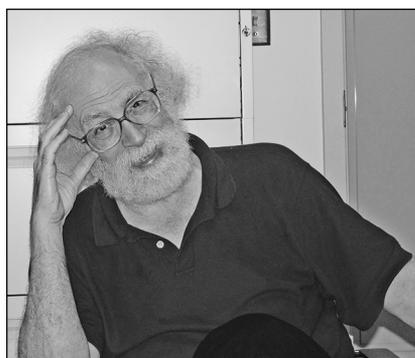
Steve Rallis

Steve Rallis was born in Bennington, Vermont, in 1942. He was an undergraduate at Harvard, receiving his BA in 1964. From there he moved to MIT where he was a student of Bert Kostant, receiving his Ph.D. in 1968. His early work was on invariant theory. After graduating from MIT, Rallis spent two years at the IAS in Princeton and two years at SUNY StonyBrook, followed by a number of visiting positions at Strasbourg, Texas, Notre Dame, and Princeton. Along the way, the primary focus of Steve's research shifted to the theory of automorphic forms and representation theory, but always keeping invariant theory as one of his powerful techniques. In 1970 Steve married Michele Kaufmann, who had received her Ph.D. in astronomy from Harvard in the same year that Steve graduated from MIT. In 1977 he became a visiting assistant professor at Ohio State University. He became a tenure-track assistant professor the following year and moved up through the ranks, staying at OSU throughout the rest of his career. But he always kept a busy traveling schedule, making regular visits to both Strasbourg and Israel, where he had active collaborations for many years. He became professor emeritus at OSU in 2008 and passed away in 2012.

The primary focus of Steve's research was automorphic forms, automorphic representations,

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and their L-functions. His work was very original and has left a lasting impact on number theory and representation theory.

Michael Harris

Steve Rallis used to apologize before explaining his new ideas. It was one of his most endearing habits, and it was always a cue to pay close attention. Number theorists have been especially attentive to his work of the 1980s and 1990s in connection with what is called the Rallis inner product formula, which calculates the inner product of a pair of theta functions as a special value or residue of a Langlands L-function. As developed and refined in an extended series of papers with Piatetski-Shapiro, this formula provides an effective classification of poles of L-functions of classical groups. Combined with Shimura's explicit local calculations (which inexplicably fail to refer to Rallis's work), Rallis's formula provides the most natural starting point for the study of p-adic L-functions of classical groups; a striking application is the proof by Skinner and Urban of the Iwasawa-Greenberg main conjecture for elliptic modular forms. Kudla and his collaborators have adapted the formula to analyze the central derivatives of L-functions in the setting of a vast program, combining representation theory with Arakelov theory, to generalize the Gross-Zagier formula.

Number theory has yet to absorb all the lessons of Rallis's more recent work, but the process is beginning. His series of papers with Ginzburg and Soudry provided the basis for the results of Jiang and Soudry on the local Langlands correspondence for generic representations. His papers on the relative trace formula, mostly with Jacquet, have been of crucial importance in recent work of Wei

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Zhang and others on the global and arithmetic Gross-Prasad conjectures. □

Steve was always a collaborative mathematician. Of the ninety-four citations listed on MathSciNet, all but seven are joint papers. Among his seventeen collaborators were Gerard Schiffmann, with whom he collaborated off and on for forty years, as well as Hervé Jacquet and part of his "Israeli team" David Ginzburg and David Soudry.

Gerard Schiffmann

"Hi, Gerard. What's up? I found this paper; it might be useful for us!" This was a typical start of a day working with Steve. Never short of ideas, always enthusiastic, very tenacious—once convinced that something should work, he would never give up until he succeeded.

I first met Steve in Princeton. Both of us were spending the academic year 1969–1970 at the IAS. We started to work on the oscillator representation. It took us several years, two of which Steve spent in Strasbourg. It was perhaps at that time that he adopted his amazing work schedule: six or seven days a week from early in the morning to late in the evening! Steve went back to the States and eventually settled in Columbus. Also that year in Princeton I met Michele for the first time, just a few months before their wedding. Later during their stay in Strasbourg my wife and I had many occasions to visit with them. Early in their relationship Michele recognized Steve's gift for mathematics and his devotion to research. Remarkably, throughout Steve's career she managed to maintain her career in astronomy while facilitating his life in mathematical research.

I met Steve again in 1987. He had invited me to Columbus, the first of a long series of visits. Mathematically, he had matured and within a few years he had become a leading expert in his field, due in part to his collaboration with Piatetski-Shapiro. Feeling less pressure, he relaxed and enjoyed more of the social life of the university. He did his best to play the absent-minded professor, hardly visible among the piles of papers in his office, but I remember many discussions with him on topics outside mathematics. He remained highly focused on his work but was very perceptive of everything around him. He had a sharp mind, sometimes a sharp tongue, but above all he was a very generous person with his collaborators and his students.

The last years were sad. Until the end, he tried to go on with his work, but he was less and less able to do so. The last thing we did, in 2011, was to rewrite a short note of his which complemented one of his old papers. I wish I could still hear him say, "Hi, Gerard. Let's start a new project. What are you up to…." □

Hervé Jacquet

I wrote a few papers with Steve Rallis. Since Steve had many collaborators at the same time, this was somewhat of a challenge because, at times, one had to struggle to get his attention. At a conference, for instance, one had to wait patiently in line to get a chance to talk to Steve. Moreover, it was difficult to keep track of the ongoing work of Steve with other mathematicians (work which could be relevant to my work with Steve). On the other hand, once one could get Steve's attention, working with him was a pleasure. I still have lengthy unpublished notes from our collaborations.

Steve's erudition was astonishing. Rather than looking up a reference in the mathematical literature, it was much easier to call Steve on the phone to find out the facts.

Of the papers we wrote together the most interesting ones are also the most tentative. There are papers where we conjecture or simply suggest new relative trace formulas. Steve's erudition was of paramount importance in formulating these conjectures. □

David Ginzburg and David Soudry

"Hey, the first team is here!" We still hear Steve's voice, greeting us happily, each time the three of us met. Indeed, we were a team, and Steve was our captain. Steve used to come to Tel Aviv and visit Piatetski-Shapiro, already in the early 1980s. Each one of us was a graduate student in those days. Steve had a keen interest in our work, listened to questions, gave his advice, and shared his vast knowledge and his personal ideas generously. Steve became our mentor, and as the years went by, we teamed up and worked together, visiting each other frequently. Working with Steve was a great experience for us, still very vivid in our minds: Steve's great passion for mathematics, his enthusiasm and devotion; times of breakthrough, moments of frustration; meeting together the next morning and sharing our separate thoughts of the night before; taking a break and getting coffee or ice cream, playing pool, or bowling. Together with Steve, we did our best mathematical work.

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Rallis and his coworkers.

We feel very privileged to have known Steve, to have learned from him and worked with him. Working with Steve was accompanied by many conversations about life, personal memories and experiences, dreams, hopes, and fears; history, politics, literature, art, films, and so much more. He was a true friend. Steve will always live in our minds: Steve the great mathematician and Steve our great beloved friend. □

Steve was known as an excellent postdoc mentor. This is probably because when he brought post-docs to OSU, he expected to collaborate with them and treated them the same way he treated his collaborators, as equal partners in their endeavors. He was eager to share ideas and engage mathematically with them. All of his postdocs left OSU as stronger mathematicians than when they arrived, and they continued to collaborate with Steve long after they left. Among his postdocs were David Ginzburg, above, and Erez Lapid.

Erez Lapid

Steve Rallis was a devoted mathematician, full of ideas and very generous in sharing them. I've known Steve from his frequent visits to Israel in the 1990s to work with his close collaborators David Ginzburg and David Soudry. Typically, he would come in December to avoid the long, idle winter vacation in the U.S. I became closer to him as a postdoc at the Ohio State University during the years 1999–2002. This was the most productive period of my career, and I couldn't have asked for a more supportive, dedicated mentor. The "harmonic analysis and automorphic representations" seminar (known as the "HAAR seminar") that Steve organized became

a hub of activity and attracted speakers from all over the U.S. and beyond on a regular basis. It became one of Steve's trademarks as is reflected by his email address: `haar@math.ohio-state.edu`. Mathematics was a top priority for Steve. He pursued it tirelessly and was extremely effective in multitasking. At the same time, Steve loved his daily routine and never seemed in a hurry. Steve cared a lot about the development of his current and former postdocs and took a keen interest in their mathematical upbringing. He will be remembered as a great mathematician who largely shaped the field of automorphic forms. □

Steve never had that many students. In his entire career at OSU he had five students total, beginning with Dihua Jiang, who later became a collaborator. Steve was a pretty demanding advisor, probably because he also treated his students as if they were collaborators. This could be quite daunting in the beginning, but if one survived, the experience was quite rewarding. Among Steve's later students was Ameya Pitale.

Ameya Pitale

I was very fortunate to have Steve as my thesis advisor. He was very generous with his time and ideas. I recall one summer when I used to meet with Steve and Cary Rader every day for a couple of hours. This was before I had obtained any results towards my thesis, and it was very frustrating to me when every angle of approach seemed to fail. I still remember Steve's comment that I was actually learning to be a mathematics researcher—you get to a good idea only after hitting a million dead ends, and the key is to keep working. This advice has stayed with me since then and has indeed helped to shape me into the mathematician that I am today. □

Steve was a definite presence in the OSU mathematics department. He would come in every morning and start making his rounds. He would check in with the staff, visit with his colleagues, talk with his visitors and his post-docs, meet with his students (usually in the lounge with others present), and still manage to teach his classes. He seemed to be everywhere, except his office; there was no point in trying to call him during the day. But he came back to the department after dinner to work and kept the same schedule on the weekends; then you had a better chance of finding him in his office working, but still ready to talk mathematics. His work ethic was an inspiration to all.

Steve could also be a polarizing presence in the department. Steve was deeply committed to the OSU

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mathematics department and had definite ideas about the direction that the OSU department should take in terms of hiring and growth...and he had no qualms about sharing these. Two of his long-time colleagues in the department were Paul Ponomarev and Bob Stanton.

Paul Ponomarev and Bob Stanton

Historical sources depict Socrates as a "gadfly" who strolled the agora and challenged the "wise" men with simple questions—of course, eventually, it cost him his life. In our department Steve was an incarnation of his ethnic ancestor. The agora—all the floors of the department, most importantly the chairman's suite; the "wise" men—colleagues who sounded off authoritatively. It was our good fortune to have Steve come by our offices three to five times a day, but few of our chairs were enlightened enough to appreciate his several daily visits to them. Was he more than a "gadfly"? During his time with us he was a positive force in the department, a presence that could never be ignored. He tried to stop bad appointments but was not always successful, and he championed excellent appointments; he ridiculed, perhaps not always within collegial bounds, misguided policies advocated by certain "leaders" in the OSU department. He left his mark on the department, but with time any mark wears off, and his leadership has been sorely missed since the onset of his illness.

His presence in the department gave it a visibility not seen since, whether it be through the conferences he helped organize at OSU, the speakers he brought to the HAAR seminar, the collaborators and postdocs who came for long visits—from Israel, the United States, Europe, and Asia.

He was also a friend—faithful when in need and with a ready amusing story when glum. In return, we had ample opportunity to respond in kind. We used to kid him about his purported resemblance to Jerry Garcia until the day on High Street when visitors to the university stopped us to ask for Jerry's autograph. Until the end, we could tease him about his classes: the world expert on automorphic forms who became the prime expositor of real analysis to mathematics education majors, acquiring the reputation among them as the "teddy bear" of the department. We can't kid him anymore, but we will never stop telling stories about him. □

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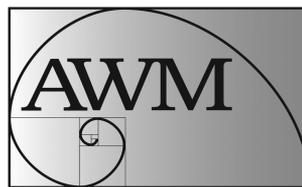
ASSOCIATION FOR
WOMEN IN MATHEMATICS

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AWM sponsors a wide variety of activities for women at all levels, from middle school to university faculty. **AWM** programs include research conferences and workshops, lecture series and prizes, travel grants, an essay contest, and day-long workshops for middle and high school girls.

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- *President*
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