

## MEMORIAL TRIBUTE: ARUNAS LIULEVICIUS (1934-2019)

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In the early to mid-1960's, Arunas was using state of the art computers to try to compute the  $E_2$  term of the Adams spectral sequence computing the stable homotopy groups of spheres [1]. At the same time, in my thesis, I introduced a spectral sequence that converged very slowly to that same  $E_2$  term [8]. Computers then being very primitive, I was able to go much farther and much faster by ordinary human means. Arunas and Saunders MacLane engineered a Winter and Spring visit for me in 1967, and one day in March, 1967, Arunas took me to lunch and asked if I would be interested in an offer. This was less than three years after my PhD. I was a complete innocent and had the unmitigated gall to say "yes, but only if it is tenured". (I had some slight figment of justification from a conversation with the then chair at Yale). That is why I am at Chicago.

Arunas and I ran algebraic topology together at Chicago for many years, and he was a wonderful colleague. I remember many Midwest Topology Seminar parties at his house, with his wife Ausrele. Arunas was a far stronger mathematician than he himself understood. He was diffident to a fault. He had thirteen graduate students, the last getting his Ph D in 1975. I had seven students through 1975. After that, he actively preferred algebraic topology students to work with me, even though I had ridiculous numbers. He was always helpful to them and several of them might have been better off with him, as I told him, but he would have none of it.

He was much quicker than I at many things. For instance, I stopped taking notes at talks because he would take far better ones and lend them to me. His diffidence extended to his mathematics. His thesis [7, 2] solved the odd primary analog of the Hopf invariant one problem, whose solution by Frank Adams was announced in 1958 and was one of the great starting points of modern algebraic topology. His subsequent work has many under appreciated gems, and there are two lovely sets of lectures notes. The first is "Characteristic classes and cobordism", from 1967 [3]; one chapter is called "Bundles over  $B \times I$  (homotopy classification of numerable bundles using the hot dog lemma)". The second is "On characteristic classes," from 1968 [4]. Its reviewer wrote "These lecture notes are unusual in combining rigour and precision with a delightfully informal style. There are copious exercises, hints, and warnings to the reader who will finish the notes feeling extremely friendly to the author." I tried to get him to publish these notes in a real book, but his modesty would not allow him to be persuaded. Two quirky titles of later papers illustrate his sense of fun: "Characters do not lie" [6], "Houses with chimneys: a curious periodicity in  $H_*(MO)$ " [5].

He loved teaching and he loved students. He was unfailingly kind and friendly to everyone, even the arrogant ones like me who didn't deserve such nice treatment. He made me feel at home at Chicago from day one, and I'll always be grateful.

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