

Hans Duistermaat and Henri Poincaré

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In my recent contribution for an In Memoriam for Hans Duistermaat in the notices of the (Dutch) Royal Mathematical Society I described the important role that Hans played in the early days of my career. The interested reader can also find this on my website (<http://www.math.ru.nl/~heckman/>). Here I would like to talk about our contact in the last year of his life.

It started with a master class I have been teaching over the past few years for high school students in their final grade. In collaboration with Maris van Haandel, a high school teacher in Wageningen (with a PhD in functional analysis), we taught over the course of 6 Wednesday afternoon sessions the basics of calculus, finishing with a discussion of the proofs of the three Kepler laws of planetary motion. It was a wonderful experience to work with these talented high school students.

In the process of going over the various proofs of the ellipse law in the literature, Maris and I found yet another proof that we liked best for use in our class. When I mentioned this proof to Hans he reacted positively, but, when I told him that the original proof by Newton was incomplete (as I had read somewhere in the literature), Hans was critical and suggested that I read Newton's original text. This was a great advice, since we were to discover - after some translation into modern language - how beautiful and complete the original proof of Newton really was. We explained this in an article in the *Mathematical Intelligencer*.

In September 2009 Maris and I organized a training weekend for high school teachers on the possibilities of teaching the Kepler laws in high school. For the Friday evening we invited Hans to give an informal lecture on Poincaré and his influence on classical mechanics, and he happily accepted. However, a few weeks before the training weekend, I got an e-mail from Hans telling me that there was a problem. That same Friday evening there was a ping-pong competition and his club simply could not do without him. We arranged the following deal: Hans would write up his lecture and explain some of the details to me, then I would give his lecture.

When I visited Hans in Utrecht to discuss his lecture it occurred to me that he had grown older. He mentioned very briefly that he had not been too well of late: that spring his spleen had been removed, but things were now under control. Hans gave me a wonderful two hours of private tuition on Poincaré's

work on celestial mechanics: the restricted three body problem, the Poincaré slice, the return map, the twist map, the stable and unstable manifold and their intersection, leading to the homoclinic disorder. Looking back at his notes it struck me how his interest in Poincaré is related to his early (and in my opinion best) work with Victor Guillemin on spectral asymptotics of positive elliptic operators.

On top of this Hans gave me yet another hour of his time, answering and commenting on some of my questions on Lagrange points and related spectral asymptotics. It was a truly delightful morning with Hans at his best. The next and last time I spoke with Hans was in December 2009. With enthusiasm he told about his ping-pong evening, how his club had won and had been promoted to a higher division. I did not know what to say when Erik van den Ban called me up that Friday in March and told me that Hans had passed away early that morning. All I can say now is repeat what I wrote in my previous eulogy, namely that I am very lucky that Hans shared his godsent talent with me so generously.