

# LIGHT-HEARTED OPTICS: EMAILS FROM THE PAST!

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**Abstract:** Every endeavour has its share of interesting people. This article provides a few light hearted anecdotes featuring some of the seminal figures in the South African optics history. The material presented in this paper was written by Heinz Klee in a number of emails during June 2009. Every attempt was made to retain the playful and tongue-in-the-cheek style in which it was originally written.

**Key words:** CSIR, NPRL, Optical Design, Optics.

## 1. INTRODUCTION

*Hi Heinz!*

*I got your email address from Derek. He told me you are moving house at the moment. good luck!*

*I have been asked to give a historical overview of optical engineering in the country, at the SMEOS conference in September.*

*Since you were right in the middle of the optics scene for many years, I would like to learn some from your memories.*

*Would you be able to assist me in such a venture?*

*thanks!*

*Nelis*

Hello Nelis,

You quite right: I was in “the thick of it” for many years. I need to warn you however, that many firsts in optical design go to “sincerely yours”. However, I shall give you what I can remember, bit by bit, in installments.

There were many achievements in optics, apart from optical design, that have received international recognition. The people responsible did not, however, receive the local recognition that they deserved.

I shall try and put something together, person by person, and try and send you something every second day. OK?

I need to draw your attention to an obvious fact: Whatever I write about people from the CSIR is mainly based on my own views, and describes the way I have experienced them. Fundamental to this experience is the fact that my description is necessarily biased and subjective. As much as I like to be objective in these and other matters, I cannot quantify my objectivity. Anyway, bear this in mind.

Best regards,

Heinz

Here we go<sup>1</sup>.

## 2. DR. V.D.M. LESSING

My first man in ZA optics is Dr. v.d.M. Lessing, or just Dr. Lessing. Some of my accounts are based on personal

<sup>1</sup>Dear Reader, please be aware that Heinz Klee has one of the sharpest tongues in the entire creation! Added to that, he does not hesitate to speak his mind. Enjoy the ride....

experience, and some are based on what several colleagues told me at the time.

Lessing, the man and scientist.

In the Soviet Journal of Optical Technology Lessing has been credited for being the first to develop computational methods that minimise the individual powers of the optical elements in an apochromatic triplet. These methods were at the time not computer based, but rather based on analytical, manual methods.

Lessing also developed the first optical design program in South Africa. First on a ZEBRA computer, the very first computer available to the NPRL. (ZEBRA = Zeer Eenvoudige .... Ask Dirk if he can remember the meaning of the acronym.) Developing this program became his life work. I recall going into his office. He had several writing desks in his office, all of which were covered, (almost to the ceiling!!), with print outs from the line printer at our computer centre. For himself he had reserved a minimal amount of space, not much larger than the width of his chair, because his own desk was also covered with print outs to the ceiling, in a shape of a U.

Lessing was an enthusiastic, but not very advanced chess player. I recall one Monday morning: He came into our office (I shared an office with Hans Bouwer, another optical designer) and started telling us about his experience playing chess against a dedicated chess computer that he had just bought for himself. At the time, (1979/1980) these computers were not very advanced. Nevertheless, they could give a club player a hard time. Anyway, with a painful expression on his face he admitted that the chess computer had beaten him. Then he burst out: “Ek was so vies vir dié ding...!!!” (I hope that my Afrikaans is more or less correct...)

Lessing drove an old DKW car. I cannot say for sure what model, but it was certainly pre-war. (1936 or 1937) Anyway, he always came to work in this car. One day he asked Rupert Diering, one of our mechanics, to set the breaker points on the DKW. He still had a manual for the car, and since the car was sold into an English speaking country

the dimensions were all in inches. So, the manual suggested that the breaker point gap should be 16/1000 of an inch. Since Rupert did not have an inch feeler gauge he used the closest metric equivalent, namely 0.4 mm. Fine. When Lessing learned that Rupert wanted to use this feeler gauge on his car he objected most vociferously: After all, 16 thou is 0.406 mm, and certainly 0.406 mm is NOT equivalent to 0.400 mm! A long argument ensued, in which Lessing had to grudgingly give in...

That brings me to Lessing's education. He was a physicist, with a strong mathematical bend. In the 1950s he went on board of one of the Union Castle liners to England, in order to study optical design at the Imperial College. He told me that on this journey he studied the book "Applied Optics and Optical Design", by A.E. Conrady. Anyway, once in England he designed several systems, and concluded with a rather well performing microscope objective. This objective was actually built in England, and photographs taken with the aid of Lessing's objective were sent to the NPRL of the CSIR. I saw those photographs, and wanted them when he retired. Lessing gave those photographs to Ernst Hecker (Hecker will be dealt with in a later part), with the instructions to simply discard them. That's when I laid claim to them. Unfortunately, Lessing then just happened to walk into Hecker's optical workshop, and caught me with these photographs in my hand. I said to him that I would take them, because they would certainly be of historical value one day. After listening to me, he demanded the photographs back. He said in effect that if those photographs were of any use to me they would also be of use to him. I am afraid that these records perished with him.

One more thing that may be of interest. I mentioned above that he developed a method of minimising the individual lens powers in a triplet. He described a mechanical method, I think in the Journal of the Optical Society of America (JOSA), by which these individual powers could be minimised. This required a rather expensive construction, with lengths of rods being suspended from a mechanical roof over another platform. A piece of string would then be used to establish a line in space, from one rod tip to another. Another piece of string would then be used to connect this line with the tip of another rod or a mark on the table. I cannot recall which. Anyway, it was a mechanical contraption that allowed one to establish a plane in space. (Three points define a plane..) Now hear this: This mechanical contraption was actually built, and was generally and unlovingly referred to as "The Glockenspiel". Of course, only when Lessing was not present. A visiting optical designer from the US, in 1980, exclaimed when he saw the "Glockenspiel": "He built it! He actually built it! Unbelievable!" This visiting designer was, incidentally, familiar with Lessing's work.

Dr Lessing was an avid (and excellent) chess player. When Len Dicks challenged him to a game, Dr Lessing would only allow play as follows: games are played by writing down the move on a piece of paper, to be handed to the opponent once per day. Only once Len had won a

sufficient number of games with this correspondence-style play, would Dr Lessing allow him a face-to-face match.

Lessing was a man of many interests — he remembered even the smallest detail of literally all sporting events; the dates, the scores, who played, memorable events, all of it! He also kept accurate rainfall records. On one occasion, his rain gauge was broken and he recorded the rainfall with a wheelbarrow. He meticulously measured up the shape and slant angles of the wheelbarrow hull and proceeded to calculate the rain rate to within measurement tolerance with other records!

All in all, Lessing was quite an original. If you analyse what I have written you will find that Lessing achieved a number of firsts, not only in South Africa but also world-wide.

That's one down.

Heinz

Nelis, please let me know if what I have written is what you have in mind. If not, don't let me carry on regardless.

### 3. DR G RITTER

The next original is George Ritter, but the man only.

I cannot say anything about his scientific activities, because when I joined the Optical Sciences Division in 1978 he was fully occupied, as head of the Optical Sciences Division of the NPRL, with administrative matters. I do know that he was a Rhodes Scholar, and that he got his D. Phil. at Oxford. (At Oxford you don't get a Ph.D., I am told.) Also, his field was lasers which is for sure not my field. But Ritter was certainly the man who brought lasers to South Africa, (in 1965, I believe) and hence became the father figure of lasers. Dirk, who was head of the CSIR laser programme for some time will be able to tell you more about his scientific achievements.

Below are only some snippets:

Ritter was an immensely compassionate man, and as his former colleague Dick Turner put it: "George is loyal to a fault." However, George was also an immensely excitable man, who, when he got into a rage, literally foamed at the mouth! I recall doing night vision work in the lab termed "Fort Knox". (It was so named because secret optical instruments were kept in there, as well as secret documentation during the sanction years. It also featured a massive walk-in safe, in which the most sensitive stuff was kept. At one stage we had several R4 rifles in there, plus a lot of ammo.) But I digress... Fort Knox was virtually across the corridor from George Ritter's office in Building 4, which housed the NPRL. Anyway, I was in Fort Knox, doing some measurements in total darkness. (OK, we simulated star light.) I then heard raised voices coming out of George Ritter's office. I soon realised that it was just one voice, namely George's. Ritter's office door was closed, and of course, the door to Fort Knox was closed as well. At that day Ritter was screaming on top of his voice

at the head of the Laser Section, one Vic Hasson: “NO, I AM NOT GETTING PERSONAL!!!...”, I recall, quite vividly. You can imagine as to what had been previously said... Incidentally, Vic was the bane in the life of Ritter, and had the knack of pushing poor George to the brink of madness.

Some time later, the decision was made to form the South African Optical Society. It took a while, until all the paper work was done and then it was announced: “Yes, it is official, we shall have a South African Optical Society”. OK. The opening address was to be delivered by George Ritter, a decision which everyone thought was very fitting. As D-day drew closer, Ritter became increasingly agitated and nervous. So one day, when he was literally galloping past me in the corridor, (yes, the very same corridor as the one mentioned in the previous section), I stopped him and asked him what his problems were. He told me, wide eyed, that he was worried about his opening address. I then remarked: “But George, you have achieved so much, why worry about this speech of yours?” He immediately flew off the handle, wagged a finger at me, under my nose, and shouted: “You can talk! You can talk! If you give a talk in our lecture hall there are only two people who can contradict you! And they know the rules! **They — know — the — rules!**” And off he went... I might mention here that Ritter’s opening address was very successful, and was also immensely well received.

Ritter’s secretary, Ina Esterhuisen (later Ina Kok), very often showed me the messages Ritter had written on a piece of paper, instructing her to do one or other thing. She said to me: “Look at his writing. He is immensely agitated again. I can tell by the size of his writing. The greater the agitation the larger the letters!” And so it was: Sometimes a single short sentence filled an entire A5 page.

But George was also an immensely decent man, and very chivalrous to women. A gentleman of the old school, indeed. Time and again, over the years, he would knock on the door of our computing office, stick his head through the door while saying apologetically: “So sorry to disturb, but did you see so-and-so recently?”, or whatever. It should be remembered that he was the Head of Optical Sciences, and not some low-down worker. Later on, after the take over of Productiontek by Aerotek, those creeps from Aerotek would just barge in, either into a closed room or into a discussion, without any prior attempt to make their intentions known. I recall flying off my handle a number of times with these individuals, and chucking them out of my office, because their behaviour was absolutely uncouth. Having rubbed shoulders with George Ritter was a good thing indeed, because George was also a very cultured man.

I could tell many other stories about him which simply showed that he was human. His aberrations were such to make him a very interesting man. He had strong views, and expressed those vociferously.

Perhaps I am stating the obvious. I have searched for

George Ritter on the Internet and immediately found the following abstract:

*LASER INDUCED DAMAGE IN COPPER CRYSTALS*  
*Appl. Phys. Lett. 9, 272 (1966);*  
*James Murphy and George J. Ritter, National Physical Research Laboratory, Pretoria, South Africa*  
*Single high power output pulses from a Q switched ruby laser are focused onto thin copper crystals. Diffraction contrast transmission electron microscopy reveals that so called black spot defects are introduced in the samples, within the laser produced crater areas. These defects are similar to those observed, for example, in neutron irradiated copper samples. They cause a marked increase in hardness at and near the crystal surface.*

That’s two down, and a couple more to go.

Heinz

#### 4. HANS BOUWER

To write about Lessing was easy; because he was such an original. My former colleague Hans Bouwer, who hailed from the Netherlands, must surely have been the most colourless person I have ever met. Hans was very clever, spoke Dutch, French, English, German and Afrikaans fluently. He could also speak, read and write Latin. But his originality lay in being extremely colourless. My comment may seem unkind, but that’s the way he was. So Hans is not a good subject for your talk

I am working on the next one, which you should have by Monday next week.

Best regards, also to everyone else I know there.

Heinz

Note: The following two stories was obtained from another source, not from Heinz:

Hans was the top chess player in the CSIR chess club and his meticulous chess playing technique was also applied to his professional career. Hans always desired to do a perfect design. This could take months! But some designs were not perfect, and never saw the light of day. The designs that were delivered, were outstanding.

Another story has it that Hans designed a lens for a military sensor — with no specification on the spectral range, he insisted on doing a broad-band design. A very good broad-band design with seven lens elements. A perfect design! Another scientist in the thin film group was making filters for the same system: two narrow band filters at 700 nm and 800 nm.....

On one occasion someone sold a dozen or two eggs to Hans. The next day Hans approached the person, enquiring on the health of the chickens — do the hens have a high fever? He was really quite insistent on the matter that some of the hens must have had a very high fever. It turned out that the

farmer had inadvertently put two hard boiled eggs in the crate with the fresh eggs delivered to Hans!

## 5. STRASSHEIM – HECKER – KLEE

Today's characters are several: Dr. Strassheim, Ernst Hecker and myself as well. The scene is the NPRL in December 1981, at which time Dr. Strassheim was director of the NPRL.

Strassheim had a fad, to put it mildly, which consisted of a yearly cleanliness inspection of the entire NPRL. Shortly before Christmas Strassheim would rock up, with his lackey Hans Erasmus in tow. Erasmus carried a clipboard, on which all those issues that had raised Strassheim's disapproval or anger were recorded. Now you must know that one of Strassheim's pet hates was the habit that some of us fostered, namely the storing of books on the broad window sills. That is, if you were privileged enough to have a window seat.

That particular year Ernst Hecker<sup>2</sup>, the head of the optical workshop, instructed his men to be so efficient in the yearly clean up operation that Strassheim would not have the slightest reason to instruct Erasmus to record anything, not even the smallest insignificant item would land up on the clipboard. That attitude, in my opinion, was suicidal and proved to be so. Nevertheless, I kept my mouth shut and instead piled more books on to the window sill, in order to immediately antagonise Strassheim, as soon as he would walk into the office. For a very good reason, as you will see.

The day arrives, and so does Strassheim with his lackey. Now at the time I shared an office with Hans Bouwer, and I was in possession of the window seat. The window sill, as mentioned, was packed with my books. As Strassheim walked into our office his eyes immediately fell on my "illegal book shelf".

"But Heinz, how can you! You know that in an orderly place you should not place books on the window sill. If someone from outside...bad impression...reputation... and blah blah blah..."

When he was finished, he gave a cursory glance to the rest of the office, and left. Erasmus had, of course, recorded the incident. But all of the sweat and tears Hans Bouwer had put into his part of the office, to get it into a very good orderly shape for the inspection, went unnoticed. The disorder in my part of the office also went unnoticed, as planned. "Give the guy ammo for his pet hate, and he will stay out of my hair!" That was my reasoning, and it had worked. As you can imagine, to remove the books from the window sill took no more than two minutes. So, mission accomplished!

Anyway, Strassheim continues and enters Hecker's workshop. The workshop is immaculate! Strassheim

does not believe his eyes. Eventually, Strassheim crawls around on all fours, looking for the soft underbelly, and he finds it. There was place, hidden by some machinery and careful camouflage, where Hecker and colleagues had not cleaned in years, because the space was very awkward indeed. Hecker was duly shat on from a dizzy height, Erasmus gleefully recorded the heinous crime, and Strassheim disappeared, deeply satisfied with himself, I am sure.

Hecker later on visited me, with a hang dog expression, in order to cry on my shoulder: "I could have sworn that I had a bullet proof case. But who would have predicted that the old bugger would go down on hands and knees to find something...." Anyway, we had a good laugh about it afterwards...

Nelis, this time I won; but that was of course not always the case. You have to realise though that by reminiscing one tends to remember the good things, and to forget the bad. That is inevitable, I am sure, and part of our survival instinct.

Regards,

Heinz

Incidentally, I have no spell checker on this computer. If anyone finds more than the usual number of spelling mistakes he/she may keep them. I have no use for them. : )

## 6. PETER TRENDLER AND ALUMINIUM POLYGONS

Here is an account of something entirely different:

It concerns a South African "First", namely the manufacture of a 300 mm "diameter" (18 sided?) aluminium polygon that was manufactured by means of a diamond fly cutting process. The late Peter Trendler, a Brit who had come to South Africa many years ago, and who had spent some years at the NPL in Teddington, England, was the driving force behind the entire project. This project was indeed not for the faint hearted, because it included the design and the building of the entire fly cutting machine from scratch, which utilised home made air bearings.

The other problems associated with the manufacture of the optical surfaces was to obtain the correct cutting geometry of the diamond, and to develop methods for the grinding and sharpening of the diamond. Other issues were the sourcing of the correct and suitable ALUMINIUM alloy from within South Africa. (And NOT diamond alloy) Suitable, of course, for the machining by means of diamond fly cutting. Since South Africa recycles very little aluminium the alloys there are very good to excellent for machining by diamond. If you recycle you will often find silicon inclusions, which are very bad.

Peter started this venture sometime in the late seventies, I believe. The first result of Peter's effort, that I saw, was a 100 mm diameter concave mirror. That was in 1985.

<sup>2</sup>Mr Hecker, a 'Master Optician', was imported from Carl Zeiss in Jena, Germany in 1952. He truly was the father of optical manufacture in South Africa.

The entire venture came to a grinding halt after Peter's retirement in December 1991. Thereafter the machine was scrapped, sometime in 1993? Aerotek decided that anything that came out of Productiontek was inferior anyway. Point is that with all their loud mouths they could not even design a small air bearing. When I battled with the high speed bearing design for the high speed camera, the director of Aerotek, Johan Fritz, said to me: "What does a ?\*#@ optical designer know about air bearings?!" I answered: "Not much. But I'll be glad to hand over the bearing project to one of your experts." Silence. No further comment.

Ask Mark Holloway about this fly cutting machine<sup>3</sup>. I had sent Mark to study the machine and to try and get it operational again. At least Mark will be able to give you some technical details.

There must be some pictures and publications regarding the manufacture of these polygons, because Peter Trendler's department actually exported these polygons to overseas customers. The old Sciendaba records will surely have reported on this project. I do know that there was a Canadian Company who bought a few of these polygons. They were truly of excellent quality, but I cannot recall the flatness that Peter was able to achieve.

Peter had a terrific sense of humour. Both he and I were Programme Managers under Maurice McDowell. At our Programme Manager's meeting, when I disliked something, I would use my scathing sarcasm to make sure that everyone there knew about my displeasure. Peter would then regularly quip: "Heinz, your German jokes are no laughing matter!"

Do you know the difference between a German and an Austrian?

In a nut shell:

During the first World War a German Commander found himself and his troops surrounded by enemy forces. He managed to get a message out: "Our situation is very serious, but not hopeless!"

An Austrian commander found himself in a very similar situation. He too got a message out. He wrote: "Our situation is hopeless, but not serious!"

Best regards,

Heinz

## 7. HEINZ ON HEINZ

Hello Nelis,

You mentioned that some of my designs have had my name attached to them. That is true. However, I never requested that; people just did that without asking my permission.

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<sup>3</sup>Mark indicated that the machine was dismantled and sold as scrap metal.

In 1981 I was asked by Dick Buchroeder, formerly of the Optical Sciences Center of the University of Arizona, whether I would co-operate in the design of a corrector for a nominally two metre diameter,  $f/2$  paraboloid. I can no longer recall who it was for. Anyway, the telescope was to operate in the visible red and near IR. The total FOV was to be in the order of one degree. Now here comes the catch: Apart from correcting the coma, astigmatism and field curvature of the mirror, and apart from having to be colour corrected, and apart from restricting the lens diameters to less than 250 mm, and apart from having to utilise cheap glasses, and apart from limiting the number of lenses to five, the image had to be free from distortion as well. There had been previous attempts by many others, designing correctors for paraboloids, and the designs of Wynne are notable here, but all of these introduced distortion. The correction of distortion, with a corrector having spherical surfaces only, had resisted all attempts until then.

I was fortunate in finding a very good solution for this problem, and my design was built in the USA. The business card of my little business in South Africa, "Klee Optical Systems cc", features a schematic of my corrector design as a logo. This design is known, at least in the US, as the "Klee corrector". Today a modified version of it, (modified by Buchroeder), is utilised in telescopes engaged in the search for potentially dangerous asteroids. I am justifiably proud of this design. After all, it was a world first.

There are some other, smaller designs for amateur astronomers that carry my name as well. But the corrector is really the most important one, as far as I am concerned.

Of course I had some first's also in the military field. But those designs do not carry my name. I am sure many of us have had a similar experience.

That's it.

Regards,

Heinz