

An overview of Michel Breger's career

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Who is Michel Breger? You can find him on the Austrian Academy of Science's website as:

Mag. rer. soc. nat., Dr. phil., B. Sc., M.A., o. Prof. Michel Breger

and that is impressive! (Although few of us have much idea what it all means.) He was born Michel (as pronounced in German with a guttural "ch") and still is Michel to his university administration and to the Austrian Academy of Sciences; he is Mike (from his South African and American nick-name) to his many students past and present, and to most of the international astronomical community – this is even occasionally anglicized to Michael; he is even "Mi-shell Brezhair" in France and Quebec! Mike is a man of many names, but for his more than 35 postgraduate students and many others he is also known as "mentor", and all of us know him as "friend" and "colleague".

I (DWK) was Mike's first PhD student at the University of Texas over 30 years ago. When I say that today to his current students and postdocs, I get a look of utter disbelief! I can see in their eyes that they are thinking, "But Mike Breger is so *young*; how could he have supervised an old guy like you?" Well, Mike is 8 years older than I am, although he appears not to age. I can assure you that he does – just at a much slower rate than most of the rest of us – and Fig. 1 proves this.

Mike went to school in East Germany following the war; Fig. 8 shows him in a school picture at age 8 in 1949. Then in 1952 his family moved to Swakopmund, Namibia (then South West Africa) which at the time was an officially tri-lingual country where there was good German-language schooling. When it came time to go to university, Mike looked to the best university in Africa – the University of Cape Town (UCT) – where he studied mathematics and physics from 1960 – 1964. Fig. 2 shows his graduation picture.

Mike was searching for an honour's project for his final year at UCT, and a friend, Tony Fairall (now professor of astronomy at UCT), made a fateful suggestion. According to Tony: "We were both students in Driekoppen Res, though Mike was about 2 years senior to me. When he expressed an interest in astronomy, I volunteered to take him to the Royal Observatory. I rode on the back of Mike's Vespa scooter, introduced him to Dick Stoy and David Evans, and the rest is history!" Mike was impressed particularly with Stoy, who was then the director of the observatory. He found, as he puts it, "Dick Stoy put students at the telescope!" And that lesson stuck. Mike Breger throughout his career with the many students he has supervised "puts students at the telescope". That is still true today at a time when this is becoming harder as astronomers work in ever larger groups and much observing is service observing on large telescopes.

During Mike's honours year at UCT he not only got to observe, but he clearly showed that he likes to write and he likes to publish – four papers in the *Monthly Notes of the Astronomical Society of South Africa* (MNASSA) appeared in his final undergraduate year:

1. Breger M., 1964, MNASSA, 23, 41: A Note on the Relation between the Radial Velocity and Variation for RR Lyrae Stars
2. Breger M., 1964, MNASSA, 23, 64: Photoelectric Observations of HH Pup



Figure 1: Mike Breger was born 8 August 1941 in Oberhausen, Germany.

3. Breger M., 1964, MNASSA, 23, 112: Provisional Radial Velocities for 9 RR Lyrae Stars
4. Breger M., 1964, MNASSA, 23, 117: A Note on the Mean Luminosity of RR Lyrae Stars

At the end of his undergraduate years Mike got a job for a short while as a Radcliffe Observatory Assistant at the 74-inch (1.9-m) telescope in Pretoria (now at the Sutherland station of the South African Astronomical Observatory – SAAO). There he learnt spectroscopy, but this was at a time when the detector was a photographic plate. The observer had to spend his afternoons cutting photographic plates in pitch darkness to the correct size of the plate holder. This was done with a diamond blade and by feel. You could tell which side of the plate the emulsion was on by touching it lightly with your tongue! The emulsion side was slightly sticky and a little bit sweet; the other side was just smooth glass. Then the observer spent the night at the eyepiece guiding the star up and down the slit by eye to broaden the spectra for better signal-to-noise, and then finished in the morning developing the plates by feel in the dark (or at best under very dim red light for blue plates): developer, wash, fixer, clearing agent, drying rack. Finally, the day was spent measuring the spectra. Sleep? What is that? Mike observed all night and almost went blind measuring tiny spectra in a dark room all day. He then changed back to photometry fast! (Even though it only paid \$16 a month.) Thus he was led (driven?) to a career in photometry.

On finishing his undergraduate degree, Mike wanted to go to graduate school in astronomy and sought advice. Everyone said the same thing: Go to the best university. For his undergraduate training that is what he had done while staying relatively close to home (it is "only" about 1600 km and four days and three nights by train from Swakopmund to Cape Town). For graduate school he chose the University of California at Berkeley on San Francisco



Figure 2: Mike - on the right with two friends - on "Jammie" (Jameson Hall) steps at the University of Cape Town in 1964.

Bay in the USA. He arrived there in 1965 into the height and heart of the "hippie" era, the free-speech movement, the free-love movement, and the anti-Viet Nam War demonstrations. In the last few generations there can be no more evocative time and place to have been a student than at Berkeley in the 1960s.

Mike quickly discovered a talent for organization. His first demonstration had already been organized in Cape Town to protest against the high price of food in the student cafeteria; Fig. 3 shows him and his fellow students cooking on camp stoves in the cafeteria to undercut the official prices. In California, he joined the committee to save Haight-Ashbury. This is a neighbourhood of beautiful Victorian San Franciscan mansions centred on the corners of Haight and Ashbury streets which was run-down in the 1960s and inhabited by hippies, students, and other young people, "drop-outs", and, of course, drug-users – although this mostly meant relatively soft drugs such as marijuana and LSD at the time – as well as being a centre of rock music. It was a time of the Grateful Dead, Timothy Leary, Ken Kesey, Joan Baez, be-ins and love-ins. Mike grew his hair down to his waist (although, unfortunately, we have no pictures to prove this!) - quite a change from the tie-wearing arrival in 1965 seen in Fig. 3.

It was during these grad student years that Mike gave his first trembling talk at an American Astronomical Society meeting where he presented the results of the millimag photometry he had been doing and some of his first small-amplitude δ Scuti star light curves. (At the time 0.01 mag precision was considered to be good photometry, so Mike had increased the precision by a factor of 10.) At the end of his talk two famous photometry pundits, who will remain unnamed, got up and stated their doubts that such precision could be obtained at all. Two theoreticians (Martin Schwarzschild and John Cox) replied that all of his results were quite logical and that the constancy of the comparison stars proved the reality of the small-amplitude light variations. As Mike says, "It just goes to show that theoreticians can be kind to frightened graduate students."



Figure 3: Mike and his fellows cooking and selling food in the Cape Town student cafeteria in 1962 in protest against high prices. Mike discovered a talent for, and love of, organization at this time.

It was also at this time that Mike was offered his first job with a company in the Bay area working on satellite guidance using stars. He declined the job, and it turned out to be a good thing he did, as the project was working on a spy satellite and it is doubtful whether a hippie-protest-organizer was the person they were looking for.

With the pattern set at UCT in his undergraduate honours' year, Mike continued with the discoveries and publications. The years 1965 – 1969 were the years of discovery in δ Scuti stars, and the time when a new standard of photometric precision was set:

1. Breger Michel, 1969, PhDT: Variability Near the Instability Strip in the Delta Scuti Region.
2. Breger M.; Sanwal N. B., 1968, ApL, 1, 103: Short Period Variability of B, A and F Stars. I. A Coma Cluster Delta-Scuti Type Variable
3. Breger M., 1969, AJ, 74, 166: Short-period variability of B, A and F stars. II. Photometry of new Delta Scuti stars.
4. Breger Michel, 1969, ApJS, 19, 79: Short-Period Variability of B, A, and F Stars. III. a Survey of Delta Scuti Variable Stars
5. Breger Michel, 1969, ApJS, 19, 99: Short-Period Variability of B, A, and F Stars. IV. Variability in the Lower Hertzsprung Gap
6. Breger M., 1969, ApL, 3, 67: Short-Period Variability of B, A and F Stars. V. The Coma Cluster and NGC 752

The bright star δ Scuti was discovered to have radial velocity variations as early as 1900 (Campbell & Wright 1900). In 1935 two papers in PASP noted the character of the variability of δ Scuti (Colacevich 1935, Fath 1935). They were short notes by A. Colacevich and E. A. Fath who noted: "the radial velocity is variable with a period of ... $4^{\text{hr}}38^{\text{m}}9$... The short period and small amplitude, together with the light variation ..., show that this star is in all likelihood not a real spectroscopic binary." The time span from that report – a time when the pulsating nature of δ Scuti was still a mystery – to Mike Breger's PhD thesis at Berkeley was only 30 years. There had been progress in the study of δ Scuti stars in those 30 years, and they were by 1965 recognized as a class of pulsating variable star, but the real advances in the field date from Mike's seminal PhD work and the five papers listed above. The state of the art now is still defined by work that has been led by Mike Breger, as can be seen in the selection of just some of the light curves obtained by the Delta Scuti Network (DSN) seen in Fig. 4. One of the problems of such high precision photometric work is that it is now difficult to find truly constant comparison stars! In Mike's opinion: "Constant stars are awful!"

From 1969 to 1972 Mike was a postdoc at the State University of New York at Stony Brook on Long Island where he worked with Steve Strom studying the polarization of pre-main sequence stars. It was at that time that he began his interest in high precision polarimetry, going on, as usual, to develop ways of getting higher precision observations that had been previously possible. He was also thinking about the possibility of pulsation in pre-main sequence stars, but was mentally fixed on T Tauri stars, and they cannot be seen directly because of their thick circumstellar envelopes. Steve said, "Well, why don't you look at Herbig Ae/Be stars?", and Mike thought, "Of course. Why not look at A stars? How obvious!" The result was the discovery of the first pre-main sequence δ Scuti stars. The study of pulsation in such stars and the ultimate goal of distinguishing their structural differences from post-main sequence δ Scuti stars is now a field in its own right. It started with these papers from Mike at Stony Brook:

1. Breger Michel, 1972, ApJ, 171, 539: Pre-main sequence stars. I. Light Variability, Shells, and Pulsation in NGC 2264
2. Breger Michel, Dyck H. Melvin, 1972, ApJ, 175, 127: Pre-main sequence stars. II. Stellar Polarization in NGC 2264 and the Nature of Circumstellar Shells
3. Breger Michel, 1974, ApJ, 188, 53: Pre-main-sequence stars. III. Herbig Be/Ae stars and other selected objects

Mike had a request from Ed Burke in 1972 to help him figure out the variability of an F star, but it refused to yield its mystery at that time. Thus the γ Dor stars waited many more years to be discovered. You don't win them all.

Mike had been observing at Kitt Peak and made friends with many people there. He got a phone call one night asking him if he knew that his supervisor, Steve Strom, had taken a new position at Kitt Peak. As such job moves often happen, this rumour got back to him before Steve had had the chance to tell him himself. It meant that Mike was back in the job market and there was a good one advertised at the growing Department of Astronomy at the University of Texas at Austin. Both Mike and his good friend Myron Smith applied for the job with Mike advising Texas that Myron is "an excellent spectroscopist" and they should hire him, and Myron advising Texas that Mike is "an excellent photometrist" and they should hire him! In the end Texas created another position and hired them both! (See Fig. 5.)

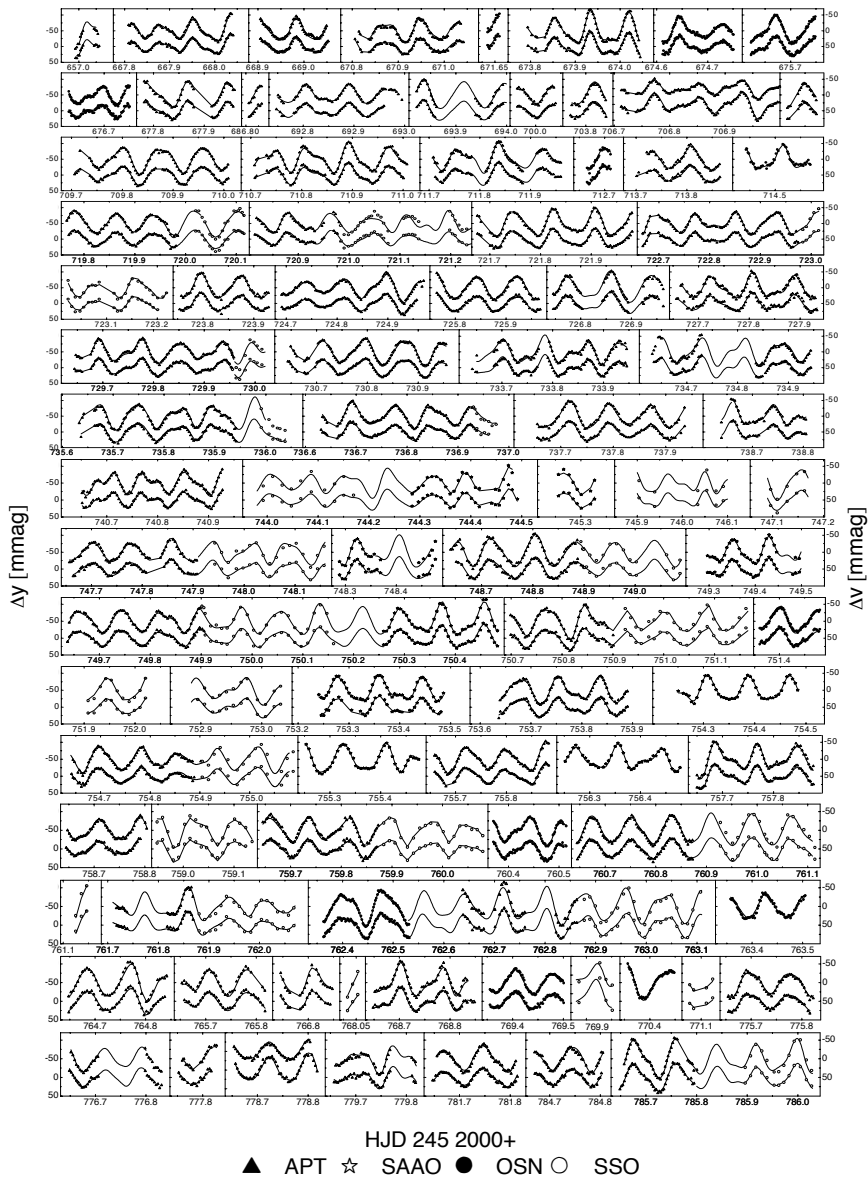


Figure 4: Light curves of the δ Scuti star FG Vir from which over 75 pulsation frequencies were found. From Breger et al. (2005).



Figure 5: Mike Breger and Myron Smith in 1972 at the time they went to Texas.

For the occasion of this conference in honour of Mike's 65th birthday, Myron sent the following letter:

Dear Mike –

The picture of you from 1974 [Fig. 6] captures your outgoing friendliness then as now. Recall what a unique history you and I have had – lay aside astronomy for a moment. We met while we were students folk-dancing. You had come to Tucson to observe at Kitt Peak. In the years that followed in Austin, we folk-danced for several years in the same groups (plural!), and this became so much of our social lives. When you would go off on conferences or trips, you would come to my apartment and I would go through the steps that you had missed! Later, in 1975, you were the best man at my wedding. In the Texas astronomy department, we became the mirrored images of instruction for photometry and spectroscopy. I think one of our better accomplishments was the summer hands-on course for grad students for observing techniques at McDonald Observatory. Look at the students that went through the system to later become a who's who of observational stellar astronomy, going on such diverse careers as being responsible for spectroscopic instrumentation at the Keck, to leaders in asteroseismology, to the exchange of astronomical FITS files and "serialization" for the Virtual Observatory. I do an injustice to leave out so many others! Those days were not always carefree



Figure 6: Mike Breger in 1974.

– remember the discussions of those *other folk* (theoreticians, women) and of drama over tenure. I remember that win or lose, you were always there with a helping hand to me and with your adage: “things are never as good or as bad as they seem.” How true that was for the unfolding events to follow those, sometimes of insignificance and other times of lasting importance. What is clear to me from the States is that your decision to leave Texas for Vienna had lasting and wonderful consequences, and your present conference is just a part of it.

As ever, all best wishes – Myron

You may have gathered from Myron's story that Mike is an accomplished dancer, and even was for many years a dance instructor. This second professional career continued when Mike moved to Austria in 1984 and he acted for many years as a Lecturer for International Folk Dancing at the University of Vienna Sports Institute!

So why did he decide to give up a very promising job at one of the most prominent observatories in the US? Again, strange variable stars with controversial properties played a role. In particular, it was the chemically peculiar star 21 Com for which he had reported in a publication in 1969 light variations with periods of about 40 min. A group at the Institute for Astronomy of the University of Vienna was working at this time on CP stars and I (WWW) applied in 1979 for telescope time at McDonald Observatory to obtain high time resolution $H\alpha$ and $H\beta$ line profiles with the Coude spectrograph. It came naturally that the visitor from Vienna met Michel Breger in Austin and we quickly discovered many scientific interests in common. It did not need much effort to convince Mike to spend his sabbatical in Austria, thus he spent the spring of 1979 in Vienna. Obviously, the climate at the institute – young staff members, each of them expert in his field, all collaborating and interested in science –

and nice groups of folk dancers made Mike “home-sick”, because he returned in 1982 for half a year to Vienna. At that time he was mainly interested in polarimetry and Quasars, but still had an eye on his beloved δ Scuti stars.

Period determination was a tricky problem and Mike developed a Fortran code, running at our Digital Equipment VAX computer and which he called *PERDET*. He published a description of this software package in Volume 82/2 of the Vienna Internal Reports and a full chapter was devoted to “a possible scheme to find three periods”. Nowadays this does not appear as a big achievement, but in the 1970s it certainly was. At that time the trend was also towards analysing many stars and use statistical means to understand the group properties. Mike’s intentions were the opposite: investigate few, but well-selected samples of stars with all available tools and try to understand individual targets in detail. 4CVn and FG Vir are perfect examples for which he collected data during several decades!

PERDET was very successfully used by Mike and his international collaborators so that he decided to add new features and in particular a user friendly graphical interface what developed to *PERIOD* with its various improvements and versions. *PERIOD* is a Windows-based highly efficient tool for analysing complex light curves and is heavily used world wide in the pulsating star community. Identifying more than 80 frequencies in the δ Scuti star FG Vir would be impossible without this tool! Unfortunately, “period” is not an adequate keyword for determining the number of references to this software tool via ADS (432736 articles were selected and retrieved), but a crude personal guess would be that several 100 papers have used *PERIOD*, not mentioning unpublished research and work in student labs.

Meanwhile, Mike moved in 1982 as full professor to Vienna and succeeded Prof. Joseph Meurers, the former Director of the Observatory which became the Department of Astronomy of the University of Vienna after merging with the Institute for Theoretical Astronomy. From 1984 to 1986 and 1994 to 2005 he acted as chairman of the department, from 2000 to 2004 as Associated Dean and Dean of Studies and since 2004 as Associated Dean of the Faculty of Geological Sciences, Geography and Astronomy of the University of Vienna. Mike became involved in administrative University business in a critical time. About every 8 years politicians felt (and they still do!) the need to re-organize our University. In hindsight the effect is that inefficient people become marginalized (but they do not disappear and hence still slow down the system) and strong personalities try to take over. This process involves lots of time-consuming activities that are generally unrelated to science. It is to Mike’s credit to have governed the institute through turbulent waters without serious loss. On the contrary, he was able to recover staff positions which were already lost earlier and to secure a strong and independent position of the institute. What is truly remarkable is the fact that Mike succeeded as an administrator without giving up producing top level science!

New and powerful methods for data analyses soon brought to light problems of inadequate observations. Consequently, Mike created a global network of observatories such that program stars could be monitored continuously for 24 hours and for many days or weeks in a row. The first *Delta Scuti Network* (DSN) campaign in 1982 was devoted to θ^2 Tau and since then, 29 (!) DSN campaigns have been organized by him (Table 1). That truly is a success story.

These long stretches of high quality data allowed Mike to study for the first time on secure grounds amplitude variations (e.g., 4CVn), period changes of δ Scuti stars as indicators of stellar evolution (which they turned out not to be), and strange cyclic effects in the pulsation properties which indicate the presence of closely spaced frequencies (Delta Scuti Network campaigns needed!). The richness of observed pulsation frequency spectra also indicated early in Mike’s career as δ Scuti star-guru that non-radial pulsation (NRP) plays a significant role. Actually, in part thanks to his involvement, Europe became the leader in investigating NRP. A consequence was the need for reliable mode identifications which still is not an easy task and Mike successfully applied photometric and spectroscopic tools to solve controversies.

Bringing together many δ Scuti star researchers who are distributed all over the continents required an efficient medium for communication. Mike realized this need and he founded in



Figure 7: Mike enjoying the Vienna Workshop on the Future of Asteroseismology

1989 the *Delta Scuti Star Newsletter*. Obviously he had filled a much-felt gap, because this Newsletter quickly became very popular in the pulsating-star community. Mike was so successful that he decided to do the next step and to found *Communications in Asteroseismology* which is published by the Austrian Academy of Sciences as a refereed journal and which is meanwhile also referenced by SIMBAD and ADS. You are holding the most recent volume in your hands!

Parallel to all his scientific work on pulsating stars in the classical instability strip he acted from 1985 to 1988 as vice president and from 1988 to 1991 as president of IAU Commission 27, *Variable Stars*, was elected in 1996 as corresponding member of the Austrian Academy of Sciences and served since 1997 as member of the board of directors for the journal *Astronomy & Astrophysics* and since 2000 as member of the governing board of the Space Research Institute of the Austrian Academy of Sciences.

Circling our Sun 65 times, most of it devoted to Astronomy and with outstanding results in science as well as in academic administration surely is a strong reason for a celebration. That is why the *Vienna Workshop on the Future of Asteroseismology* was initiated in his honour. It obviously did not only please the participants who arrived from all over the world, but also our guest of honour:

Michel Breger.

Table 1: Delta Scuti Network campaigns until 2005

DSN	target		DSN	target	
1	θ^2 Tau	1983	16	4 CVn	1997
2	4 CVn	1984	17	CD-24 7599	1998
3	θ^2 Tau	1986	18	BI CMi	1998
4	HR 729	1988	19	BI CMi	1999
5	BU Cnc & EP Cnc	1989	20	44 Tau	2000
6	63 Her	1990	21	44 Tau	2001
7	HN CMa	1990	22	FG Vir	2002
8	CD-24 7599	1992	23	FG Vir	2003
9	FG Vir	1993	24	44 Tau	2003
10	IC 418	1993	25	FG Vir	2004
11	CD-24 7599	1994	26	44 Tau	2004
12	θ^2 Tau	1994	27	HD 210111 & AS Eri	2005
13	IC 418	1994	28	UV Oct & SS For	2005
14	FG Vir	1995	29	44 Tau	2005
15	4 CVn	1996			

Acknowledgments. Our sincere thanks go to: Eva Breger, for smuggling the family photo collection from home to a conspirative meeting; Myron Smith, for digging in his and his sister's private photo archive, and Victoria Antoci, for improving ancient photos.

References

- Breger M., Lenz P., Antoci V., et al., 2005, A&A, 435, 955
 Colacevich A., 1935, PASP, 47, 231
 Fath E. A., 1935, PASP, 47, 232
 Campbell W. W., Wright W. H., 1900, ApJ, 12, 254



Figure 8: A school class picture from 1949 when Mike was 8 years old. Can you find him? He is the boy with the "professorial" look third from the left in the back row.

Delta Scuti and roAp stars





Douglas Gough and Don Kurtz in friendly discussion at the conference dinner.



Patrick Lenz and Alosha Pamyatnykh thinking about the next models to compute.