The last years of the David Dunlap Observatory: Personal Reminiscences

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The text describes my association with the David Dunlap Observatory in years 1985 - 2008. It is a highly personal view: The DDO evolved from the first place of my employment in Canada to a research facility which I managed on daily basis before the sale of the grounds and the DDO closure.

A bit about my own history prior to 1984

It may be useful to review my own life choices on the way from Poland to Canada - my peregrination between two distant astronomical observatories, the Warsaw University Observatory and the David Dunlap Observatory.

Our first stay in Canada took place in 1975-1977. I was then a Research Associate at the Dominion Astrophysical Observatory in Victoria, BC, arriving straight from Poland to become the first NRC Plaskett Fellow (https://astroherzberg.org/about-us/plaskett-fellowship/former-plaskett-fellows/). This was my second long-term stay abroad; the first was a Post-Doctoral Fellowship at the University of Florida in 1970 - 1971. My wife and I had no intention to emigrate from Poland to Canada in 1975 - 1977; we indeed returned there and I continued at the Warsaw University Observatory. In 1980, I was invited to the Max-Planck Institute for Astrophysics in Munich, Germany. This is where I worked for the next 2 years, 1980 to 1982. Following that stay, I took another two-year research position at the Institute of Astronomy in Cambridge, UK (1982-1984). The continuing political instability in Poland could lead to various outcomes; among them, we considered a possibility of a massive Soviet military intervention of the type we are now witnessing in Ukraine. These thoughts forced us to think about emigration. Canada - known to us from the stay in Victoria in 1975 to 1977 - seemed an excellent place for a permanent settling. We had really enjoyed our previous stay in Victoria. Importantly, thanks to my experience with several early astronomical satellites, Prof. Gordon Walker from the University of British Columbia offered me the position of a Scientific Manager of the astronomical satellite project "StarLab", with him as a Principal Investigator. It would have been a major research facility estimated to cost a few hundred million $ of that time. It would be an excellent opportunity to me. Unfortunately, the Canadian portion of the funds were cut off by the federal agencies in 1984 and the project was cancelled.

But this happened when all official procedures were advanced and we were emigrating to Canada... Fortunately Professors Tom Bolton and Stefan Mochnacki arranged for me a "cushion" which - on our arrival in Toronto in December 1984 - took shape of a temporary Research Associate position at the David Dunlap Observatory supported from their research grants. I was given a desk at the DDO and could continue my own projects. This is when DDO started to become part of my life...

The first years in Toronto: 1985 - 1997

I felt confident enough to start teaching at the Department of Astronomy of the University of Toronto in the 1985 academic year. My employment was on a contractual basis as an Assistant Professor. This gave me an opportunity to learn about differences in teaching between Poland and Canada; it also permitted me to look around and see possibilities for a further employment. While I kept a desk space at DDO, I did not use the 1.88m telescope which seemed to me rather heavily utilized. I did try - over a few months - to use the photometric system consisting of the 0.5m and 0.6m telescopes developed by Prof. Don Fernie, but did not like running between these two, somewhat distant telescopes and I gave up on that. I had plenty of material collected in previous years: I worked mostly on the data acquired at the European Southern Observatory in Chile and the data from various first-generation astronomical satellites (IUE, ANS, OAO-2, OAO-3). The Assistant Professor position permitted me to apply for federal research grants. This arrangement continued to 1987 when - unexpectedly - Profesor Donald MacRae, the former Head of the Department[1] told me about a newly created Provincial Centre of Excellence, the Institute for Space and Terrestrial Science (ISTS); possibly I could find a more stable position there. I had not known Professor MacRae, but heard about him and he apparently knew about me. I also sensed that although he was retired, he was well informed about the departmental personnel situation at Toronto. I followed his advice and took the new job at ISTS in 1987.

The work environment at the ISTS was nice and I did not mind an obvious lack of research atmosphere: I could freely continue my own work, while research contacts continued through my Adjunct Prof. position at UofT. In fact, I obtained an identical position at the York University where I did some graduate-level teaching. My main employment-related activity at the ISTS was aimed at establishing contacts with the space industry of Ontario. I quickly realized that astronomical applications - e.g. a small photometric telescope in an orbit focussed on small-amplitude variability - were not generating much interest among engineers. I was usually very politely listened to but then nothing came out of my attempts to continue contacts. In fact, these efforts eventually resulted in a success in the form of the MOST satellite, but this happened much later (see below). Thus, for several years, my liaison duties at ISTS were limited to appreciating the high expertise level of Ontario space companies who were not interested in federally-funded, presumably poorly supported, small-scale projects.

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[1] Profesor McRea was the last Head of the Department. Now the position name is the Chairman.

My DDO connection continued through these years. I typically spent two-three days of every week to work on my data in the peaceful and research-conducive atmosphere of the DDO. During the decade of 1987-1997, I spent about equal amount of time at ISTS, DDO, the downtown UofT offices, with occasional visits to the York University. Somehow I had time for all those places and for a rather productive research resulting in several publications. During that time one of my graduate students at York, Mr. Wen Lu, started using the 1.88m telescope; he later became the telescope night assistant. Through Wen, I tried to implement a new technique of spectral analysis which I had started developing on data acquired at the Canada-France-Hawaii Telescope in 1985-1986. I called it the Broadening Functions Technique and it became later my main data-analysis tool.

I looked forward to each visit to the DDO where I had excellent conditions for research work, far from the business atmosphere kept at ISTS. It was also nice to meet interesting people. I was sharing my office with Professor Helen Hogg. She was very kind and polite. She liked pointed, well-focused conversations. She would come for one or two hours and usually seemed very busy. My visits to DDO gave me also an opportunity for encounters with the departmental professors: In addition to my former "employers", Bolton and Mochnacki, I was meeting the former Chairman of the Department, Don Fernie and the current (at that time) Chairman, Ernest Seaquist. I was also meeting Robert (Bob) Garrison and John Percy. Karl Kamper did research in astrometry and was in charge of photography and optics. Several 4th year and graduate students working with these professor and using the 1.88m telescope were coming and going; the atmosphere was friendly and pleasant. The technical staff were interesting to interact with: the mechanics Dave Blyth and Archie Ridder, the electronic specialists Shenton Chew and Vlodek Kunowski, the janitor Frank McDonald, the 1.88m telescope night assistants, Jim Thomson and Wen Lu. Later, the night assistant Heide DeBond and the versatile technician Yakov Voronkov joined the technical DDO staff. While the matter of a closure of the DDO surfaced in discussions from time to time, the observatory seemed to operate quite unperturbed through those years - at least I did not notice any obvious change over those ten years, 1987-1997.

I went three or four times to Las Campanas Observatory in Chile to use the UofT 0.60m telescope of the Department. The discoverer of the famous Supernova 1987A, Ian Shelton (the former UofT student) was then the UofT Resident at Las Campanas. I was privileged to partially give my observing time to permit Ian to continue photometric observations of the Supernova until the end of its observing season. These were the early times of computer use for observations and the Internet was still to be invented. Voice communications between the UofT station at Las Campanas and Richmond Hill were done using the short wave receivers with antennas on the DDO grounds.

The first Canadian astronomy satellite: MOST

A major change in my life took place in 1997. The ISTS started its phased closure a year before. It was exactly at that time when I met an engineer who was willing to listen to my ideas of a small astronomical satellite able to observe variability of stars continuously

utilizing a special sun-synchronous, dawn-dusk orbit. An idea of a small astronomical satellite was not generally popular: It was assumed that - for proper stability - an orbital telescopes must be large and massive; the Hubble Telescope with dimensions of a school bus was a mental standard here; the computers and stabilization system devices were bulky and heavy. In contrast, Dr. Kieran Carroll, associated with the UTIAS (University of Toronto Institute for Aerospace Studies) and working at Dynacon Enterprises Ltd was involved in development of miniaturized stabilization systems - a necessary subsystem for a small satellite. He was enthusiastic about the idea of a small photometric satellite as a first platform to implement a novel system developed in Toronto; inherently sharp images of stars seemed ideal targets for first experiments. This resulted in a series of our meetings started in 1995 and continuing once a week for about a year when we tried to solidify details of a possible proposal to the Canadian Space Agency (CSA). In 1996, the Agency opened up a competition for funds where our idea of a satellite was facing the strong, well established sounding-rocket community distributed among several Canadian universities. After a few exploratory meetings at CSA I came to a conclusion that chances for our astronomical satellite were very low. But we still tried. The team I was able to organize included professors from several Canadian universities distributed from Halifax to Vancouver; the skeletal and shrinking administrative crew of the ISTS helped in formatting a professionally looking book of the proposal. If successful, the application would result in a first small satellite of this type in the world; it would be also one of few research satellites fully developed and funded in Canada. Such a project would fully consume the allocated funds of the Canadian Space Agency competition (about $10M) and could affect continuation of the sounding rocket program in the country. But it would open up an entirely new technical expertise of small-size reaserch and commercial satellite payloads.

In 1997, the ISTS ceased to exist and my employment there ended. I had to look for a place to earn a salary. It was a difficult time for me. I found a place for myself far from our newly established home in Toronto: My new job was that of a Canadian Resident Astronomer at the Canada-France-Hawaii Telescope (CFHT) in Hawaii. Although this meant one more - and large - move between countries, I liked the idea of working in such a special place. My wife, with her newly established high-school teaching position was much less enthusiastic, but she fully supported me.

I felt well established at CFHT after a few months of work there. It seemed that CFHT would be my place of permanent employment until my retirement in Hawaii. But things were never very stable in my life... Suddenly and unexpectedly, news was conveyed to me by phone from Ottawa: The small satellite project won the Canadian Space Agency competition! After a brief cooling period, I went to the Director of the CFHT suggesting that I would be happy to split my time between the CFHT work and the satellite involvement. But he rather quickly shattered my excitement: I was hired by CFHT to help run the observatory, not to develop satellites... Not having any permanent job in Canada, I had no other choice but to find somebody to lead the satellite project. A new leader of the project was chosen after contacts with the satellite team. It was Professor Jaymie Matthews at UBC. I think it was he who invented the name MOST (Micro-Oscillations of

STars) for the satellite. He ably directed the project through the successful construction of the satellite, the launch and the 11 years long data acquisition stage. I remained in the MOST team and fully enjoyed obtaining extensive data from the satellite.

1999: The DDO again...

Although the CFHT still operated as before with astronomers coming from Canada or France after long overseas flights, my work at the CFHT coincided with first changes taking place in large, overseas observatories: The Internet - after about a decade of experiments - started becoming able to transfer progressively larger amounts of data. The goal was to transfer voluminous data produced by electronic detectors in real time reducing the necessity of the overseas travel. While we still had visiting astronomers during my time there, the CFHT started preparations for a routine "queue-observing" mode of operations; future observations would be more similar to the use of programmed astronomical satellites. I was directly involved in those preparations. But, at home, things looked less positive: My wife was not happy in Hawaii. She missed contacts with our son's family in Toronto and her high-school teaching.

In 1998, I was happy to meet at the CFHT Professor Seaquist, the Chairman of the U of T Department of Astronomy during his visit to Hawaii on a federal-agency supervisory meeting. He told me about a DDO vacant position previously filled by the late Karl Kamper who had been the DDO Resident Astronomer for many years. I knew Karl from my association with the DDO in 1984-1997: Karl supervised the daily operations at DDO and spent much time on continuing instrumental issues there. I applied for the position and was accepted with the starting date of January 1, 1999. The position, while less attractive than that at the CFHT, would solve my home problems. We would be back in Toronto.

Professor Peter Martin became the Chairman of the Department of Astronomy and Astrophysics - and thus the Director of the DDO - in July 1999. His intentions were to accelerate the process of the DDO grounds sale; this would lead to the establishment of a new research institute continuing the Dunlap legacy, but would also result in the DDO closure. This process was expected to take a few years. Quite unexpectedly to me, Peter offered me a position of his Associate Director at DDO. He also generously offered to us the use of the Director House on the DDO grounds. My duty was to steer the DDO through its final years by managing its operations on a day-to-day basis.

Administration and management of the DDO were new activities to me. I had worked in many employment environments and in different countries, but had no experience in the administrative matters. The solution was to rely on common sense and on my relative ease with interpersonal relations. Fortunately, the most serious and most difficult personnel issues were dealt with by the Chairman/Director. By being accessible on a daily basis, I did experience some staff and nearby-resident discontent but this was unavoidable and - from the start - taken into account in my decision. I was happy to be again at the Department of Astronomy and Astrophysics and to be useful there. My wife

Anna and I moved to the Directors House in the Fall of 1999 and we happily lived there until the sale of the DDO grounds in 2008.

The short-period binary star program: 1999 - 2008

The observatory lost several technical-staff people during the final years of its existence through retirement and staff restructuring. Graduate students stopped working on projects based on DDO data, the overall level of activity was reduced. But the 1.88 metre telescope was there and just begged to be used. I felt that I should invent a reasonable observing program for a few years, a program which could deliver useful data even if terminated after a few years. This led to the DDO short-period binary star program.

A somewhat technical commentary is needed here to explain the specifics of the binary-star program at DDO: With the bright sky and the weather far from ideal astronomical conditions, spectroscopy of bright stars seemed to be the best option. The Cassegrain spectrograph on the telescope had a decent efficiency delivering various, moderate spectral resolutions thanks to a large selection of diffraction gratings. With the detector system based on a rather typical (at that time) CCD detector of 1024 pixels per side, the highest spectral resolving power R was about 17,000 ($R = c/\Delta v$, where c is the velocity of light and Δv the velocity resolution). This was sufficient for a program of systematic observations of bright (<10 mag), short-period (P < 1d) binary stars with the number of identified targets on the Ontario sky estimated at about 180 stars. The point is that a systematic and uniform spectroscopic survey did not exist at that time - in fact even at this very moment (year 2022) the DDO survey is the only such survey. The short-period binaries with orbital periods shorter than a day have components rotating and orbiting each other very rapidly with velocities reaching several hundred km/s; for such large velocities, the spectral resolution resulting from the above R-number is fully sufficient. The main problem is not the resolution, but the extremely heavy blending of strongly rotationally broadened, dense spectra. This unique problem has been slowing progress for the particular group of objects for a long time and is with us even now. I felt that DDO could contribute something new: The digital spectra of the 1980's-1990's were usually "de-convolved" using the Fourier-quotient, highly non-linear technique. This technique is known to have many traps so that observers are confronted with difficult decisions at data processing stages; different results for different observers for the same data are not uncommon. As an improved alternative, I developed a linear algebraic method taking advantage of the progress in the desk-computer power: Solutions of sets of thousands of linear equations for typically hundreds of unknowns became possible with computers of the 1990 technology. The Broadening Functions Technique had been developed on the CFHT data, but the first experimental application at DDO was on the data collected at DDO by Wen Lu [1][2].

[2] Numbers in square brackets give the publication numbers in the table at the end of this paper.

The binary star program at DDO started in full in 1999 and continued to the closure of the observatory in 2008. My original expectations were modest: At the rate of 10 stars per publication - in the expected 3 to 5 years - we would contribute data for about 40 - 60 bright (m<10 mag.), short period (P<1 day) binaries, thus roughly 25% - 35% of the targets accessible at the DDO location. Since only about 25 binaries already had published spectroscopic data, this would be a useful contribution to an improvement of statistical sample for future studies of such stars. The program would be also an excellent testing ground for my Broadening Functions technique. It should be stressed that short-period binaries are astrophysically interesting objects: About 2/3 of those solar-neighbourhood binaries are the so-called contact binaries (also known as the W UMa-type): two stars glued together and forming a surprisingly stable, double-nucleus structure. While they are rather common (one among typically 500 solar-type stars) and easy to detect because of their continuous variability, they still remain to be understood in their internal structure and evolution paths.

The short-period binary program dominated DDO activities in years 1999-2009. By the time the program ended, we collected about 4,500 spectra for 163 binaries; this corresponded to a target completeness level reaching about 85-90% (some binaries ended up with incomplete data). Most of the research papers were in the Astronomical Journal which is an internationally well recognized publication. A few additional papers with summaries and descriptions of the DDO program appeared in various conference proceedings. The main analyses appeared in 15 numbered papers of the "Radial Velocity Studies of Close Binaries" series containing 10 objects per paper. Additional papers dealt with special objects or were published outside the series because a few of our visitors insisted on having separate publications. A serendipitous discovery of very common visual companions to majority of our objects led to an additional small program "Contact Binaries with Additional Components" [24-26]. The DDO program was publicized in a few conference papers [27-31]. Lists of the papers are given in tables at the end of this manuscript. The final paper directly based on the DDO binary program appeared in 2013 [23]. Interestingly, the Broadening Functions technique seems to have been progressively accepted by the community: Dr. Dennis Crabtree (acting as a member of the Canadian Astronomical Society) informed me that his analysis indicates a continuing, but somewhat peculiar increase in my early citations related to that technique, a tendency which is unlike a standard decline observed for publications as they "age".

The observer "manpower" for the DDO binary program was provided in various ways. While Wen Lu and I were the original observers, Stefan Mochnacki was interested in the program and substantially contributed to observations. Most of the observers were the local graduate and summer students: Chris C. Capobianco, E. Liokumovich, George Conidis (York), Mel Blake (York) and the night assistants: Heide deBond, James R. Thomson, Thomas Karmo. A large fraction of observations was also collected by three Post-Doctoral Fellows funded by my NSERC research grant and staying in Toronto for typically 2 years: Theodore Pribulla from Slovakia, and Michał Siwak and Wojtek Pych from Poland. The extensive use of our equipment gave them exposure to practical

spectroscopy. Such an exposure was also useful to shorter-term (typically a month), self-supported visitors from Poland: Waldemar Ogloza, Piotr Ligęza, G. Maciejewski, Bogumił Pilecki, Grzegorz Stachowski, Piotr Rogoziecki, Krzysztof Kamiński. Poland did not belong to the European Astronomical Observatory at that time, but it seemed likely that this would happen soon. It should be noted that we also accepted additional 1.88m telescope observers from the Czech Republic, Slovakia, Hungary, Turkey, Lithuania, Ukraine, Spain, but - similarly to several Polish observers - they came to do observations of their own targets, not of our binary-star program. My main intention was to have observers utilizing the 1.88m telescope as extensively as possible. Our statistics showed a reasonably efficient utilization of the telescope at a level of about 65% of all nights; however, because of the variable weather, full, clear nights were much less common so that - when expressed as a fraction of all available night hours - the overall efficiency in terms of the actual observing time was about 27%.

The program started with a Thomson/Photometric CCD detector (as described above) installed in the focus of the Cassegrain spectrograph. This detector stopped working after a couple of years and was replaced by an identical chip. A substantial improvement in the quality of the data happened in 2004 when a new larger detector by Jobin-Yvon with 2048 pixels was purchased; it had been specifically developed for spectroscopic applications. We used it mostly with a new, high-quality diffraction grating purchased specifically for our program. These acquisitions happened thanks to site-rental arrangements for commercial cinematographic uses. The filming companies paid well, but we had to tolerate usually demanding and occasionally arrogant personnel of the filming crews. Most frequently Archie Ridder was directly dealing with their requests. Such "visits" were infrequent, perhaps typically less than one per year.

The binary star program had some additional benefits for the telescope operations: We installed a small CCD detector on one of the finder telescopes to help in object acquisition and to monitor variability of target stars. Also, the extensive use of the telescope over different sky directions permitted development of 2D lookup maps to take into account the large flexure corrections of the telescope in its coordinate setting. The coordinate target setting became easier and less dependent on the accumulated experience of the telescope operators.

The DDO operations and the telescope program were not my only activities. I typically spent two days per week on the St.George campus on teaching and seminars. In terms of my own research, I was busy analyzing data from the MOST satellite; I also organized a team of researchers from several Canadian universities interested in formulation of a smaller reincarnation of MOST which later took shape in the BRITE satellites. More information about the early days of BRITE are available at:
https://www.astro.utoronto.ca/~rucinski/BRITE/

The observatory closure in 2008

My attitude towards the expected closure of the DDO did not change during my work there: It could happen anytime and we were ready for that. Gossips about the imminent agreement of the involved parties were circulating in Richmond Hill, but became more common in the spring of 2008. While I was very aware of the local-resident discontent which took the form of the "DDO Defenders" group, I tried not to be influenced by these forms of protest - this was simply not my business... My lack of involvement was perhaps particularly visible on July 2, 2008 when the sale of the grounds was announced: I simply withdrew from any activities. We left the Director's House within a couple of months after that date. We remained appreciative to the Chairman of the Department for letting us use the House for the nine memorable years. Since we had retained our own house in the city, the DDO closure did not drastically impact our lives. I retired from the UofT one year later, in agreement with the contract signed in 1999; at that time the Ontario regulations specified the 65th year as the time for retirement. I highly valued being elected Professor Emeritus of the Department which permitted me continuing collaboration with graduate students; I could also apply for the NSERC research grant. The grant was particularly useful for my continuing involvement in the MOST and BRITE satellite missions. The last time when the funds were used for ground-based observations was in 2018; the data collected in Chile eventually resulted in my currently last published paper in 2020.

After the DDO closure, I have visited the observatory only a couple of times. I preferred to keep in my mind an image of an active place; the sad story of the McLaughlin Planetarium and the feeling of a rather poor appreciation of our own history was always on my mind. A more detailed visit depressed me: I found that the CCD detectors with their electronics and the dedicated computers were gone, and with them the possibility of spectroscopic observations. Arguably, since the telescope was never meant to be used as a visual instrument, it would be the spectrograph which could become most attractive for any further educational applications. Spectra of bright stars and of the Richmond Hill sky would best illustrate the ubiquitous light pollution and its specific sources (incandescent bulbs, a variety of metal-halide lamps, low- and high-pressure sodium lights, etc.). Society learns now faster and is ready for more intellectual challenges; an exposure to elementary spectroscopy of celestial objects could be a step beyond appreciating beautiful sky images so abundant now in the media...

Publications of the DDO program "Radial Velocity Studies of Close Binaries"

#	# DDO	Authors	Year	AJ (vol & page)	Title/subject	ADS Link	Cit
1		Lu & Rucinski	1993	106, 361	AH Vir (exploratory study)	1993AJ....106..361L	33
2	1	Lu & Rucinski	1999	118, 515	GZ And, V417 Aql, LS Del, [EF Dra], V829 Her, FG Hya, AP Leo, UV Lyn, BB Peg, AQ Psc	1999AJ....118..515L	92
3	2	Rucinski & Lu	1999	118, 2451	AH Aur, CK Boo, DK Cyg, SV Equ, V842 Her, UZ Leo, XZ Leo, V839 Oph, GR Vir, NN Vir	1999AJ....118.2451R	87
4		Rucinski & Lu	2000	MNRAS 315, 587	W Crv	2000MNRAS.315..587R	26
5	3	Rucinski, Lu & Mochnacki	2000	120, 1133	CN And, HV Aqr, AO Cam, YY CrB, FU Dra, RZ Dra, UX Eri, RT LMi, V753 Mon, OU Ser	2000AJ....120.1133R	78
6	4	Lu, Rucinski & Ogloza	2001	122, 402	44 Boo, FI Boo, V2150 Cyg, V899 Her, EX Leo, VZ Lib, SW Lyn, V2377 Oph, DV Psc, HT Vir	2001AJ....122..402L	98
7	5	Rucinski, Lu, Mochnacki, Ogloza & Stachowski	2001	122, 1974	V376 And, EL Aqr, EF Boo, DN Cam, FN Cam, V776 Cas, SX Crv, V351 Peg, EQ Tau, KZ Vir	2001AJ....122.1974R	83
8	6	Rucinski, Lu, Capobianco, Mochnacki, Blake, Thomson, Ogloza & Stachowski	2002	124,1738	SV Cam, EE Cet, KR Com, V401 Cyg, GM Dra, V972 Her, ET Leo, FS Leo, V2388 Oph, II UMa	2002AJ....124.1738R	75
9	7	Rucinski	2002	124, 1746	DDO program description.	2002AJ....124.1746R	142
10	8	Rucinski, Capobianco, Lu, DeBond, Thomson, Mochnacki, Blake, Ogloza, Stachowski & Rogoziecki	2003	125, 3258	V410 Aur, V523 Cas, QW Gem, V921 Her, V2357 Oph, V1130 Tau, HN UMa, HX UMa, VY Sex, DZ Psc	2003AJ....125.3258R	72

11	9	Pych, Rucinski, DeBond, Thomson, Capobianco, Blake, Ogloza, Stachowski, Rogoziecki, Ligeza & Gazeas	2004	127, 1712	AB And, V402 Aur, V445 Cep, V2082 Cyg, BX Dra, V918 Her, V502 Oph, V1363 Ori, KP Peg, V335 Peg	2004AJ....127.1712P	58
12		Maciejewski & Ligeza	2004	Inf.Bull.Var. Stars, 5504	V404 Peg, V407 Peg, HH Boo	2004IBVS.5504....1M	6
13	10	Rucinski, Pych, Ogloza, DeBond, Thomson, Mochnacki, Capobianco, Conidis & Rogoziecki,	2005	130, 767	V395 And, HS Aqr, V449 Aur, FP Boo, SW Lac, KS Peg, IW Per, V592 Per, TU UMi, FO Vir	2005AJ....130..767R	48
14	11	Pribulla, Rucinski, Lu, Mochnacki, Conidis, Blake, DeBond, Thomson, Pych, Ogloza & Siwak	2006	132, 769	DU Boo, ET Boo, TX Cnc, V1073 Cyg, HL Dra, AK Her, VW LMi, V566 Oph, TV UMi, AG Vir	2006AJ....132..769P	64
15	12	Pribulla, Rucinski, Conidis, DeBond, Thomson, Gazeas & Ogloza	2007	133, 1977	OO Aql, CC Com, V345 Gem, XY Leo, AM Leo, V1010 Oph, V2612 Oph, XX Sex, W UMa, XY UMa	2007AJ....133.1977P	53
16		Kaminski, Rucinski, Matthews, Kuschnig, Rowe, Guenther, Moffat, Sasselov, Walker & Weiss	2007	134, 1206	V471 Tau	2007AJ....134.1206K	30
17	13	Rucinski, Pribulla, Mochnacki, Liokumovich, Lu, DeBond, De Ridder, Karmo, Rock, Thomson, Ogloza, Kaminski & Ligeza	2008	136, 586	EG Cep, V1191 Cyg, V1003 Her, BD+7 3142, V357 Peg, V407 Peg, V1123 Tau, V1128 Tau, HH UMa, PY Vir	2008AJ....136..586R	51
18		Pribulla & Rucinski	2008	MNRAS, 386, 377	AW UMa	2008MNRAS.386..377P	41

19		Rucinski & Pribulla	2008	MNRAS, 388, 1831	GSC1387-475	2008MNRAS.388.1831R	48
19	14	Pribulla, Rucinski, DeBond, De Ridder, Karmo, Thomson, Croll, Ogloza, Pilecki & Siwak	2009	137, 3646	TZ Boo, VW Boo, EL Boo, VZ CVn, GK Cep, RW Com, V2610 Oph, V1387 Ori, AU Ser, FT UMa	2009AJ....137.3646P	44
20	15	Pribulla, Rucinski, Blake, Lu, Thomson, DeBond, Karmo, De Ridder, Ogloza, Stachowski & Siwak	2009	137, 3655	QX And, DY Cet, MR Del, HI Dra, DD Mon, V868 Mon, ER Ori, Y Sex, TT Cet, AA Cet, CW Lyn, V563 Lyr, CW Sge, LV Vir, MW Vir, GO Cyg, V857 Her,V752 Mon, V353 Peg (some binaries with incomplete data)	2009AJ....137.3655P	56
21		Pribulla, Rucinski, Kuschnig, Ogloza & Pilecki	2009	MNRAS 392, 847	HD 73709, GSC 0814-032 (MOST satellite support)	2009MNRAS.392..847P	12
22		Siwak, Zola & Koziel-Wierzbowska	2010	Acta Astr., 60, 305	BX And, DO Cas, BV Eri, VV Cet, WZ Cyg (PhD in Poland)	2010AcA....60..305S	20
23		Rucinski, Pribulla & Budaj	2013	146, 70	Metallicity determinations for W UMa binaries (combined DDO data)	2013AJ....146...70R	28

Explanations:

The first two columns give the consecutive number of the publication and the "Radial Velocity Studies of Close Binaries" series number (1 to 15). The consecutive publication number is used in the text in square brackets [ ]. Most papers were published in Astronomical Journal (AJ). The volume and page are given for the AJ papers; for other publications an established acronym is used.

Links in the SAO/NASA Astrophysics Data System (ADS) citation database
https://ui.adsabs.harvard.edu/classic-form
are listed in the penultimate column of the table.

The last column gives the number of citations as of Dec.20, 2022.

Publications based on the program "Contact Binaries with Additional Components"

#	Authors	Year	AJ (vol & page)	Title/subject	ADS Link	Cit
24	Pribulla & Rucinski	2006	131, 2986	The Extant Data.	2006AJ....131.2986P	266
25	D'Angelo, van Kerkwijk & Rucinski	2006	132, 650	A Spectroscopic Search for Faint Tertiaries	2006AJ....132..650D	122
26	Rucinski, van Kerkwijk & Pribulla	2007	134, 2353	A Search Using Adaptive Optics	2007AJ....134.2353R	105

Explanations:

The three papers of this program were published in Astronomical Journal (AJ). They were partly based on the DDO (papers #24 and #25) and partly on the CFHT data (paper #26).

For other explanations see the previous table.

Conference and symposium publications related to the DDO program "Radial Velocity Studies of Close Binaries", all authored by Rucinski

#	Year	Publication	Title	ADS LInk	Cit
27	2004	Stellar Rotation (IAU Symp. 215), p.17	Advantages of the Broadening Function (BF) over the Cross-Correlation Function (CCF)	2004IAUS..215...17R	39
28	2006	Close Binaries in the 21 Century (Coll.)	The DDO Short-Period Binary RV Program	2006Ap&SS.304..323R	4
29	2010	International conference on Binaries (CP1314)	Contact Binaries: The Current State	2010AIPC.1314...29R	16
30	2010	Binaries - Key to Comprehension of the Universe (ASP Conf. 435)	The DDO Close Binary Spectroscopic Program	2010ASPC..435..195R	5
31	2012	From Interacting Binaries to Exoplanets: Essential Modeling Tools (IAU Symp. 282)	The Broadening Functions Technique	2012IAUS..282..365R	6