TEST OF THE SWAROVSKI BTX: A TOP-CLASS BINOCULAR EYEPIECE FOR THE MODULAR SWAROVSKI ATX TELESCOPE SYSTEM.

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September 2017

INTRODUCTION.

In 2012-2013 the Austrian company Swarovski Optik generated again in its history a sort of "optical earthquake" for binocular and telescope users with the introduction of the new modular ATX/STX observation telescope system. The ATX/STX system consists of three different interchangeable objective modules with diameters of 65, 85 or 95 mm respectively. Each objective module can be connected with its bayonet mount to an eyepiece module with magnification range of 25-60x for the 65 or 85 objective module and 30-75x for the 95 mm objective module. The eyepiece module fits on any of the three objective modules.

Fig. 1 Swarovski ATX/STX 65 , 85 and 95 modular observation telescope system

Each objective module is supplied with a focussing ring as an integral part of its body (comparable to the ATS/STS and ATM/STM telescopes), which gives it a nice slim shape. Each objective module is also supplied with a ring with attached tripod platform, which is shaped as a fast-coupling plate to fit into a fast-coupling mount of a tripod (up to now that was a Manfrotto plate mount).
As already mentioned the eyepiece module can be connected with its bayonet mount to one of the objective modules. It contains a zoom eyepiece with fixed zoom range as mentioned above. Available is an ATX eyepiece for users who prefer an angled telescope or an STX eyepiece for users who prefer a straight telescope (convenient for photographers for example).
This rather versatile telescope system is now made even more user friendly with the introduction of the binocular BTX eyepiece, since it allows the user to use both eyes for observations with this telescope, which has a lot of advantages as I will explain below. Since the BTX binocular eyepiece yields a fixed 35x magnification, Swarovski also supplies a 1,7x extender, which fits between the BTX eyepiece and an objective module. That increases the magnification to 60x.

Figure 2. Top: Swarovski ATM 80 HD observation telescope, bottom: Swarovski BTX 95 observation telescope.

The introduction of the BTX binocular eyepiece fits very well into Swarovski's leading company motto: ***"improve what is already good".*** I will try to illustrate this in Intermezzo 1 below.

INTERMEZZO I: short historical overview of Swarovski telescope production.
Swarovski produces since 1935 binoculars, but it took until ***1957*** *for the production of* ***the first telescope*** *to occur; in this case a* ***30x75 draw tube telescope****.*
In ***1982****, 25 years later, followed by the introduction of two "****Doppellteleskope= Double telescopes****": **23x75 and 30x75**. These were in fact two giant binoculars with Porro prism. The instrument housing was in a rectangular case.*
In ***1990*** *the first Swarovski observation telescope appeared on the market:* ***the AT 80****, a high quality 80 mm observation telescope with Porro prisms and interchangeable zoom eyepiece.*
From then on the development at Swarovski telescopes went relatively fast: ***in 2002*** *the now internationally well-known and very successful* ***ATS/STS 80 and ATS/STS 65 telescopes*** *were introduced with a range of different eyepieces. These telescopes were supplied with modified Amici prisms and they had the same slim shape as the AT telescopes by keeping the focussing ring as an integral part of the telescope body, which gives the telescope a very elegant and slim appearance. The new prism system and the new objective including a tele lens made the ATS/STS telescope more compact and with a lower weight.*
In 2009 *the ATS/STS telescopes were further improved with the introduction of the* ***ATM/STM telescopes*** *which had magnesium telescope bodies (lower weight) and flat field optics delivering a sharp image over the whole field of view. Moreover a new 25-50x wide-angle zoom eyepiece became available for the new ATM/STM telescopes.*
But it would not take long before Swarovski hit the world of telescope users ***in 2012-2013*** *with the introduction of the breath-taking* ***new modular ATX/STX telescope system****. This system consists of three interchangeable objective modules as described in the Introduction: a 65mm, 85 mm and a 95 mm objective module, so the user can decide what type of telescope he/she wants, since the separate zoom eyepiece can be connected to any of the objective modules as described in the Introduction.*

And now ***in 2017*** *Swarovski hits the optical market again with the* ***introduction of the BTX binocular eyepiece module*** *for the ATX modular telescope system, described above.*

For information of the reader of this test report I have listed in Table 1 some data from the different Swarovski telescopes. These data were all collected by myself with the exception of the ones of the AT telescopes, which were taken from information leaflets published by Swarovski. I have also listed the measured transmission spectra of the ATM, ATS and ATX telescopes, which we have measured in the course of the years. For comparison I have also included the transmission spectra we have measured from instruments made by other telescope producers. The Swarovski spectral data also illustrate nicely, that Swarovski lives up to its company motto *"improve what is already good"* since both the colour reproduction and the amount of transmitted light is gradually improving with every new telescope type.

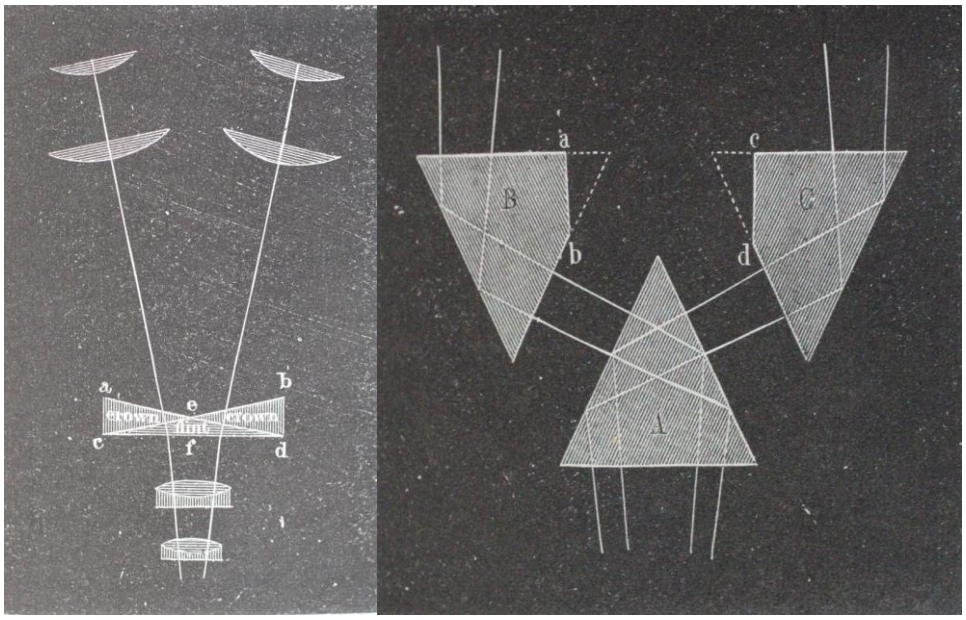
For interested readers I will try in Intermezzo 2 to give an impression of the development of binocular eyepieces.

INTERMEZZO 2:

The historical development of binocular eyepieces starts in the world of microscopy. What is a binocular eyepiece? The simplest definition is: a binocular eyepiece is a beam splitter which cuts a beam of light into two preferably identical light beams which each have half of the intensity of the original light beam'. The development and the different constructions of binocular eyepieces, which are invented have an interesting history and starts, as stated, historically in the world of microscopy.

In 1859 the Utrecht professor P. Harting published an impressive book (960 pages) with the title "Das Mikroskop, Theorie, Gebrauch, Geschichte". He published it originally between 1848 and 1850 in three volumes in Dutch, but it was such an important study for the history of microscopy that it was in 1859 translated in German, since that was the leading scientific language in that time. The 6-th chapter of Hartings German book is primarily dedicated to "multi-oculäre Mikroskope" In that chapter Harting describes with elaborate illustrative drawings what lens or prism construction Riddell (USA), Nachet (France) and Wenham (England) already in 1853 had published and constructed to supply microscopes with a binocular eyepiece, because observation with one eye for longer time periods are in the long run very tiring. Harting describes in that chapter also with many drawings, which prism- or lens construction would be most suited for a good binocular eyepiece with minimal light losses due to reflection on glass-air surfaces.

One must realise that in 1853 there was not the faintest sign yet that prisms could be used for the production in binoculars. For that to occur it would take still about half a century. Microscopes with binocular eyepieces constructed by Wenham and Nachet came on the market in the time span 1860-1900.



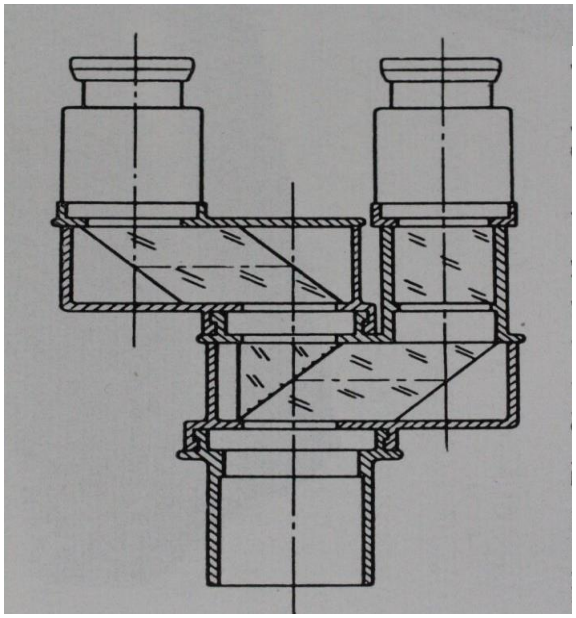
Figures 3 and 4. Left: Wenham binocular eyepiece. Right: Nachet binocular eyepiece (1850-1853).

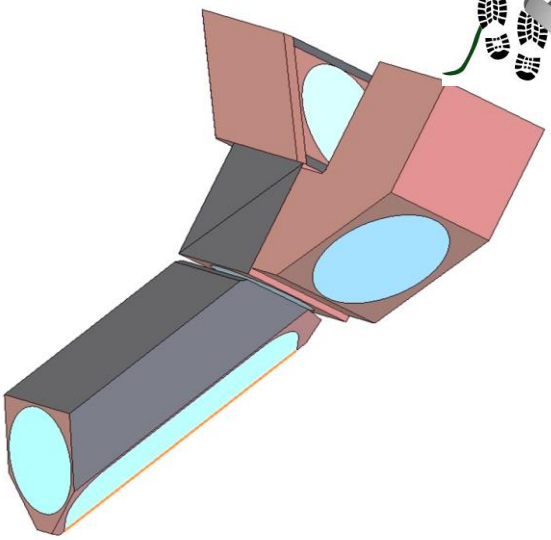
Especially the Wenham design was popular, while the microscopes with binocular eyepieces designed by Camille Sebastien Nachet (1799-1881) were only limited available. Nachet constructed optical instruments of exceptional high quality and received in his career a gold medal for the quality of his optical instruments at an international exhibition, so he obviously was a very capable optical instrument maker.

Leitz employee Rolph Beck shows a picture of a binocular Leitz microscope in his two monographs from 1999 and 2002 "Die Leitz-Werke in Wetzlar" (1999) and "Mikroskope von Ernst Leitz in Wetzlar" (2002): under which he adds the modest subscript: " Basis des Stativs C zur Darstellung des ersten tauglichen Binokularmikroskops der Welt (ab 1913)". Obviously Beck did not have a high regard for the Wenham and Nachet constructions. However, the picture described by Beck shows a very useful and, compared to previous binocular eyepieces, completely different design. It would be used in many microscopes in the years after 1913.

Figures 5 and 6. Left: microscope binocular eyepiece with hinge construction as common in binoculars. Right: microscope binocular eyepiece with eyepieces on a sliding rail to adjust for the distance between both eyes.

In microscope catalogues from Zeiss in the time period 1920-1940 quite a few different types of binocular microscope eyepiece designs were published, see for example also figures 5 and 6. Zeiss must have designed some binocular eyepieces before that time period, since in 1923 in the first edition of "Die Fernrohre und Entfernungsmesser"by Albert König the author describes with design figures on pages100-101 examples of binocular eyepieces designed by Ernst Abbe (1840-1905). To make a long story short: the binocular microscope does exist already for more than 150 years. That is, however, as far I could find not the case for binocular eyepieces for observation telescopes. That does not mean, that it had escaped the attention of telescope makers, since in the excellent book "Die Fernrohre und Entfernungsmesser", Third edition, 1959 by König and Köhler, the authors show on page 203, figure 174 a binocular eyepiece design which was named Synopter by the authors. The application and possibilities of this Synopter eyepiece is described further in the text, but the authors do not give examples of real constructed and used Synopters. As yet I have not found examples of the application of binocular eyepieces in observation telescopes on the basis of the Synopter design, so it seems that it is quite some time later that binocular eyepieces were constructed and available for (astronomical) telescopes. This group of users struggles with the same problems as microscope users and users of observation telescopes: the use of only one eye for observation with a telescope. Binocular eyepieces made for astronomical telescopes seem to be the first to fill that gap and for that purpose quite a few binocular eyepieces are now available on the market ranging in price from approximately 200-1000 euros. A few brands in this field are Baader Maxbright, Williams Optics, Celestron, Telescope Service, Orion, Omegon, Astro-Professional, Carl Zeiss, Siebert, Denkmeijer, Nedoptifa-Bleeker and Russian optical companies. These binocular eyepieces are not all suited for astro-telescopes, some are specifically made for microscopy.





Figures 7 and 8: Left: Zeiss Synopter binocular eyepiece design described by König und Köhler, 1959. Right: Scheme of Swarovski BTX binocular eyepiece 2017

In my quick study of historical developments in this field I found only two types of observation telescopes with binocular eyepieces both produced after the year 2000. It was a Cyclops 90 mm or 110 mm observation telescope with a binocular eyepiece equipped with interchangeable eyepieces (as one finds in microscope binocular eyepieces) yielding magnifications of 26x or 39 x and another 120 mm telescope from 2008. This short overview illustrates in my opinion that the Swarovski BTX binocular eyepiece for the modular ATX telescope system is a real innovation in the world of observation telescopes.

The new Swarovski BTX binocular eyepiece.

What makes the new Swarovski BTX module so special and what are its performances? I will try to answer these questions below on the basis of technical information obtained from Swarovski, on the basis of my own observations and on the basis of a number of measurements we have performed. Some of these data are summarized in table 2, so you can compare them with the data for the ATX telescope we have collected.

Figure 9: Swarovski BTX binocular eyepiece (left) with 1,7x extender (middle) and 95 mm objective module (right).

Table 1 gives a review of the most important performances of Swarovski telescopes, made in the time period 1990-2012 and in table 3 I have listed an overview of the performances of other telescope makers like Kowa, Leica and Zeiss. As far as I know none of them makes a binocular eyepiece for their telescopes. I also plotted the most relevant transmission spectra of the different telescopes, so you can compare the data yourselves. I did not investigate the BTX 85 and 65, but looking at the test data for the ATX 65, 85 and 95 I do not expect, that they differ a lot from the 95 version.

USE OF THE BTX 95.

The BTX 95 weighs almost 2800 grams and combined with the 1,7x extender almost 3000 grams. That requires the use of a tripod and a very robust tripod head. Swarovski did not overlook that, since the company introduces with the BTX module the new PTH professional fluid head (604 euros) and the BR balance rail, so the BTX 95 telescope can be balanced perfectly well on the tripod.

The distance between both eyes can be adjusted by moving the two eyepiece tubes to adjust them for the distance between both eyes with a range of 56-72 mm. That works smooth. Both eyecups can be turned in and out and they are attached with a screw mount into the BTX body, so the user can remove or apply them for cleaning or replacement, the same construction Swarovski uses for all its binoculars and telescopes. Eye relief is 20 mm, so that will be sufficient for most users wearing spectacles. Differences in strength between both eyes can be corrected by turning the eyepiece rings in accordance with the usual construction in binoculars.

To generate a steady view, the BTX module is supplied with an adjustable forehead rest, which makes extended sessions with the BTX telescope much more comfortable. If necessary it can also be removed, so it need not to bother the telescope user.

The BTX 95 is equipped with a smart aiming device, which makes aiming the angled BTX scope to the target of observation much easier. If you look at the device is seems odd considering the star shaped pattern in it, but it works perfectly well.

The image quality of the BTX 95 is very good: a beautiful clear and brilliant image, sharp until the field edges, with perfect colour reproduction. Hardly any remnant of colour dispersion.

As stated in my introduction a binocular eyepiece functions as a beam splitter. That means that the light beam generated by the telescope objective is split in two (ideally identical) light beams: one beam hits the left eye the other one the right eye. The optical system in our brains however combine these two images into one image.

We measured the transmission spectra escaping from the left and the right binocular eyepiece. The result is shown in the added plot of the spectra. The shape of these two spectra seems at first sight odd, but if you add both spectra you obtain the total transmission spectrum and that shows that all bumps etc. in the separate eye spectra cancel out completely and the result is a nice flat transmission spectrum in accordance with transmission spectra we have measured for the ATX telescope. Actually the sum transmission of the BTX 95 exceeds that of the ATS 80 HD and the ATM 80 telescopes and is almost equal to the light transmission of the ATX 95, see the tables and the spectra.

One would perhaps expect that the image clarity would decrease because the beam splitting by the binocular eyepiece supplies each eye with roughly half the total amount of light leaving the objective-prism system, but that is not really the case. That has to do with the way our brains handle the incoming optical signals. The result is that this signal handling system takes care that the brain generates an increase of roughly 40% more optical information by observation with two eyes then it does with one-eye observation. Moreover there are reliable research data which show that image resolution is better with two eyes then with only one eye.

So observation by using two eyes have a number of advantages (as the old microscopy users had already discovered a long time ago) and the BTX module makes use of it.

Since the magnification of the BTX 95 is fixed to 35x, Swarovski also supplies a 1,7x extender raising the maximum magnification to 60x. (By using more than one extender one can increase the magnification even more, but at the expense of transmitted light and a smaller exit pupil, so a decrease of overall image brightness). The extender does not take much light away, as shown in the added transmission spectrum (we measured only the transmission spectrum for the right eyepiece of the BTX). We measured a loss of about 1-1,5 % in light transmission over the whole wavelength range due to the extender, whereas the colour reproduction is not affected. However as, indicated in table 2, the size of the exit pupil decreases of course, so the overall brightness decreases a bit.

The focussing wheel turns smoothly and uses 2 turns for distances between close focus to infinity.

CONCLUSION.

Swarovski has, with the BTX binocular eyepiece for the modular ATX telescope system, produced a high quality, very beautiful and useful piece of optical equipment for the pleasure of many users, for which the designers and technicians of the company deserve compliments and esteem. Considering the recent sales interest of many customers this development seems certainly a success for Swarovski.

Acknowledgments: I am grateful to Swarovski Optik in Absam, Austria to supply me with a test sample of the BTX 95 plus a 1,7x extender and for answering my questions and giving feedback. I am also grateful to Ing. Dave van den Heuvel for his for assistance by measuring the transmission spectra.

Table 1
Data of Swarovski telescopes 1990-2017

Telescope	**Swarovski AT 80HD (data from Swarovski flyer) Introduction 1990**	**Swarovski ATS 80HD with 20-60x Introduction 2002**	**Swarovski ATM 80 HD with 25-50x Introduction 2009**	**Swarovski SV-ATX 95 Introduction 2012**	**Swarovski SV-ATX 85 Introduction 2012**	**Swarovski SV-ATX 65 Introduction 2012**
Weight (g)	1730 g	1658 g	1594 g (+25-50x eyepiece)	2194 g (30-70x.)	1931 g (25-60x.)	1600 g (25-60x)
Close focus (m)	6 m	4,8 m	4,8 m	4,5 m	3,5 m	2 m
Waterproof	Yes	Yes	Yes	Yes	Yes	Yes
Filled with dry nitrogen	Yes	Yes	Yes	Yes	Yes	Yes
Available eyepieces and their FOV (m/1000m)	**22x** (44m/1000m) **32x** (33m/1000m) **20-60x** (33-17m/1000m)	**20x** (60m/1000m) **30x** (42m/1000m) **25-50x** (42-27m/1000m) **20-60x** (36-20m/1000m)	**20x** (60m/1000m) **30x** (42m/1000m) **25-50x** (42-27m/1000m) **20-60x** (36-20m/1000m)	**30-70x** (35-19m)	**25-60x** (41-23 m)	**25-60x** (41-23 m)
Number of rotations from close focus to infinity	?	2,25	2	2,8	2,8	2,8
Measured exit pupil **P** (mm)	20x:4 mm 60x: 1,3mm	20x: 4,1 mm 60x: 1,4 mm	25x: 3,2 mm 50x: 1,6 mm	30x=3,2 mm 70x=1,35 mm	25= 3,45 mm 60x=1,40 mm	25x=2,65 mm 60x= 1,10 mm
Measured objective diameter **O** (mm)	80 mm	79,9mm	80,0 mm	94,90 mm	84,9 mm	64,92 mm
Calculated magnification **M= O/P**	20-60x	19,5x 57,1x	25x 50x	29,7x 70,3x	24,6x 60,6x	24,5x 59x
Light transmission 500 nm (night) 555 nm (day)	 80% 80%	With 20-60x eyepiece 77% 79%	With 25-50x eypiece: 82% 82%	 86% 87%	 86% 87,5%	 86% 86%
Eye cups	Foldable rubber	Screw mount.User can unscrew or replace them	Screw mount.User can unscrew or replace them	Screw mount.User can unscrew or replace them	Screw mount.User can unscrew or replace Them	Screw mount.User can unscrew or replace them
Eye relief in mm	20x: 15 mm 60x: 16 mm	20x: 17 mm 60x: 17 mm	25x: 17 mm 50x: 17 mm	20 mm	20 mm	20 mm
Suited for spectacle users:	Yes	Yes	Yes	Yes	Yes	Yes
Color reproduction		Almost neutral	Perfect	Perfect	Perfect	Perfect
Filtersize objective	?	M 82x0,75	M82x0,75	M97x0,75	M87x0,75	M 67x0,75
Tripod platforrm (mm)		42x45 mm	42x45 mm	42x45 mm	42x45 mm	42x45 mm
Rubber mantle	No, gray metal telescope body	Yes, green hard rubber	Yes, green hard rubber	Yes, green hard rubber	Yes, green hard rubber	Yes, green hard rubber
Stay-on case	Yes	Yes, 205 euro, 230 gram	Yes, 205 euro, 230 gram	Yes, 110 euro for eye piecer module and 120 euro for objective module	Yes, 110 euro for eye piecer module and 120 euro for objective module	Yes, 110 euro for eye piecer module and 120 euro for objective module
Other available accessories	Carrying bag. Adapter for mirror reflex camera	- 3 different tripods - Tripod head FH 101 - TLS 800 adapter for mirror reflex camera - adapters for digital camera	- 3 different tripods - Tripod head FH 101 - TLS 800 adapter for mirror reflex camera - adapters for digital camera	- 3 different tripods - Tripod head FH 101 - TLS 800 adapter for mirror reflex camera - TLS APO+DRX coupling device – DCB II digital camera adapter - TR stabilizer	- 3 different tripods - Tripod head FH 101 - TLS 800 adapter for mirror reflex camera - TLS APO+DRX coupling device – DCB II digital camera adapter - TR stabilizer	- 3 different tripods - Tripod head FH 101 - TLS 800 adapter for mirror reflex camera - TLS APO+DRX coupling device – DCB II digital camera adapter - TR stabiliser
Guarantee	10 years	10 years	10 years	10 years	10 years	10 years
Price Body (euros) Price eyepiece (euros) **Price complete (euro)**	 **?**	**2371** **555** **2956 euro**	**2570** **710 (25-50x)** **3280 euro**	**ATX module 1970** **95 mm obj. 1720** **3690 euro**	**ATX module 1970** **85 mm obj. 1390** **3360 euro**	**ATX module 1970** **65 mm obj. 800** **2770 euro**

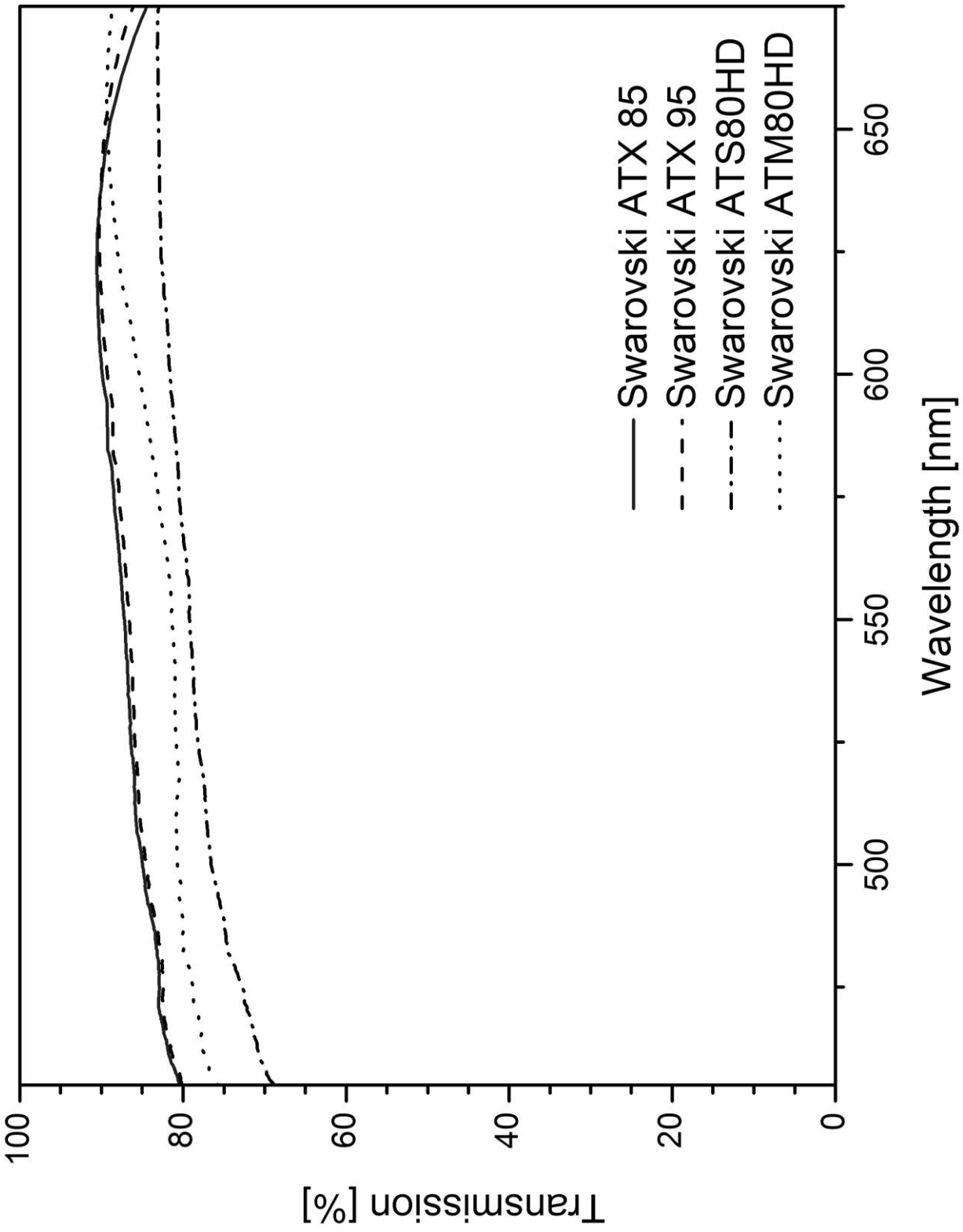
Table 2
Data of Swarovski BTX 95 compared with ATX 85 and 95

Telescope	**Swarovski BTX Introduction 2017**	**Swarovski SV-ATX 95 Introduction 2012**	**Swarovski SV-ATX 85 Introduction 2012**
Weight (g) BTX 95 Plus 1,7x extender	2794 g 2978 g	2194 g (30-70x eyepiece.)	1931 g (25-60x eyepiece)
Close focus	4,85 m	4,5 m	3,5 m
Waterproof	yes	yes	Yes
Filled with dry nitrogen gas	yes	yes	Yes
Available eyepieces and their FOV (m/1000m)	32 m	**30-70x** (35-19m/1000m)	**25-60x** (41-23 m/1000m)
Number of rotations of focussing wheel from Close focus to infinity	2	2,8	2,8
Measured exit pupil **P** (mm) With 1,7x extender	Left: 2,75 mm Right: 2, 75 mm Left:1,6 mm Right: 1,6 mm	30x=3,2 mm ; 70x=1,35 mm	25= 3,45 mm ; 60x=1,40 mm
Measured objective diameter **O** (mm)	94,95 mm	94,90 mm	84,9 mm
Calculated magnification **M= O/P** **With 1,7x extender**	34,5x left and right 59,3x left and right	29,7x tot 70,3x	24,6x tot 60,6x
Light transmission 500 nm (night) **555 nm (day)**	Left: 43,3%; right: 42,7% Sum : 86%; **Left: 45,4%; right: 43,0%** **Sum: 88,8%**	86% **87%**	86% **87,5%**
Eyecups	Screw mount User can unscrew or replace them	Screw mount User can unscrew or replace them	Screw mount User can unscrew or replace them
Eye relief in mm)	21 mm	20 mm	20 mm
Suited for spectacle users:	Yes	Yes	Yes
Color reproduction	Perfect	Perfect	Perfect
Filtersize objective	M97x0,75	M97x0,75	M87x0,75
Tripod plateau (mm)	42x45 mm	42x45 mm	42x45 mm
Rubber armoring	Yes, green hard rubber	Yes, green hard rubber	Yes, green hard rubber
Stay-on case	Yes, 177 euro for the BTX module	Yes, 122 euro for eyepiece module and 133 euro for objective module	Yes, 122 euro for eyepiece module and 133 euro for objective module
Other accessories	- 3 different tripods - PTH tripod head - ME 1,7x extender - BR balance rail - Adapters for photography with smartphones	- 3 different tripods - Tripod head FH 101 - TLS 800 mirror reflex camera adapter - TLS APO +DRX koppelstuk - DCB II digital camera adapter - TR II stabilizer	- 3 different tripods - Tripod head FH 101 - TLS 800 mirror reflex camera adapter - TLS APO +DRX koppelstuk - DCB II digital camera adapter - TR II stabilizer
Guarantee	10 years	10 years	10 years
Price Body Price eyepiece **Price 1,7x extender** **Price complete (euro)**	**BTX module 2580** **95 mm module 1910** **360 euro** **4850 euro**	ATX module 2170 95 mm obj. 1910 **4080 euro**	ATX module 2170 85 mm obj. 1540 **3710 euro**

N.B. The 1,7x extender causes over the whole spectral range measured a decrease in light transmission of about 1-1,5%.

Table 3
Comparison of data from telescopes of other brands 2014-2015
Data from Kowa, Leica and Zeiss were determined and published in 2008-2009.

Telescope	**Kowa Prominar TSN 883**	**Leica Apo-Televid 82**	**Swarovski ATM 80 HD**	**Swarovski SV-ATX 95**	**Swarovski SV-ATX 85**	**Zeiss Diascope 85 Old and new**
Weight (g)	1846 g (+ 20-60x eyepiece.)	1920 g (+ 25-50x eyepiece)	1594 g (+25-50x eyepiece)	2194 g (30-70x eyepiece.)	1931 g (25-60x eyepiece)	1730 g (+20-60x eyep.) New: 2073 g (+20-75x eyep.)
Close focus (m)	5,2 m	3,7 m	4,8 m	4,5 m	3,5 m	4,5 m
Waterproof	Yes	Yes	Yes	Yes	Yes	Yes
Filled with dry nitrogen gas	Yes	Yes	Yes	Yes	Yes	Yes
Available eyepieces and their FOV (m/1000m)	**25x:** (37 m/1000m) **30x:** (42 m/1000m) **20-60x:** (38-19m/1000m)	**32 x:** (40m/1000m) **25-50x:** (41-28 m/ 1000m)	**20x** (60m/1000m) **30x** (42m/1000m) **25-50x** (42-27m/1000m) **20-60x** (36-20m/1000m)	**30-70x** (35-19m)	**25-60x** (41-23 m)	**40x** (30m/1000m) **20-60x** (43-20m/1000m**)** **DC-4 30x** Digital camera eyepiece (30m/1000m) **New:** **20-75x** (40-16m/1000m)
Number of rotations from close focus to infinity	2	5	2	2,8	2,8	6 (oud) 6,5 (nieuw)
Measured exit pupil **P** (mm)	20x: 4,3 mm 60x: 1,5 mm	25x: 3,1 mm 50x: 1,6 mm	25x: 3,2 mm 50x: 1,6 mm	30x=3,2 mm 70x=1,35 mm	25= 3,45 mm 60x=1,40 mm	20x: 4,4 mm 60x: 1,45 mm
Measured objective diameter **O** (mm)	87,6 mm	81,2 mm	85,0 mm	94,90 mm	84,9 mm	85,0 mm
Calculated magnification **M= O/P**	20,4x 58,4x	26,2x 50,7x	25x 50x	29,7x 70,3x	24,6x 60,6x	19,3x 58,6x
Light transmission 500 nm (night) 555 nm (day)	 69% 75%	+ 25-50x eyepiece 74% 79%	+ 25-50x eyepiece 82% 82%	 86% 87%	 86% 87,5%	With 20-60x eyep. 69% 79%
Eye cups	Twist-up, can be removed/applied by the user	Twist-up, can be removed/applied by the user	Twist-up, can be removed/applied by the user (screw mount)	Twist-up, can be removed/applied by the user (screw mount)	Twist-up, can be removed/applied by the user (screw mount)	Twist-up, can not be removed or applied by the user
Eye relief in mm)	20x: 17 mm 60x: 16,5 mm	25x: 19 mm 50x: 19 mm	25x: 17 mm 50x: 17 mm	20 mm	20 mm	20x: 16 mm 60x: 16mm
Suited for spectacle users	Yes	yes	Yes	Yes	Yes	Yes
Color reproduction	Slightly yellow	Almost neutral	Perfect	Perfect	Perfect	Yellow preference
Filter size objective	95 mm	E82	M82x0,75	M97x0,75	M87x0,75	M 86x1
Tripod plateau (mm)	44x49 mm	42x42 mm	42x45 mm			28-32x45 mm
Rubber mantle	No	Yes	Yes	Yes, green hard rubber	Yes green hard rubber	No (old) Yes (new)
Stay-on case	Yes, 85 euro, 235 gram	Yes, 180 euro, 312 gram	Yes, 205 euro, 230 gram	Yes, 110 euro for eyepiece module and 120 euro for objectiv module	Ja, 110 euro for eyepiece module and 120 euro for objective module	Yes, 179 euro, 235 gram
Guarantee	5 years	10 years	10 years	10years	10 years	10 years
Price Body Price eyepiece **Price complete (euro)**	2539 with 20-60x zoom eyepiece **2920 euro**	2499 700 (25-50x) **3199** **(3380 in België)**	2570 710 (25-50x) **3280**	**3690 euro**	**3360 euro**	2289 euro 569 euro (20-60x) **2858 euro** **3178 euro** for new Diascope plus 20-75x eyepiece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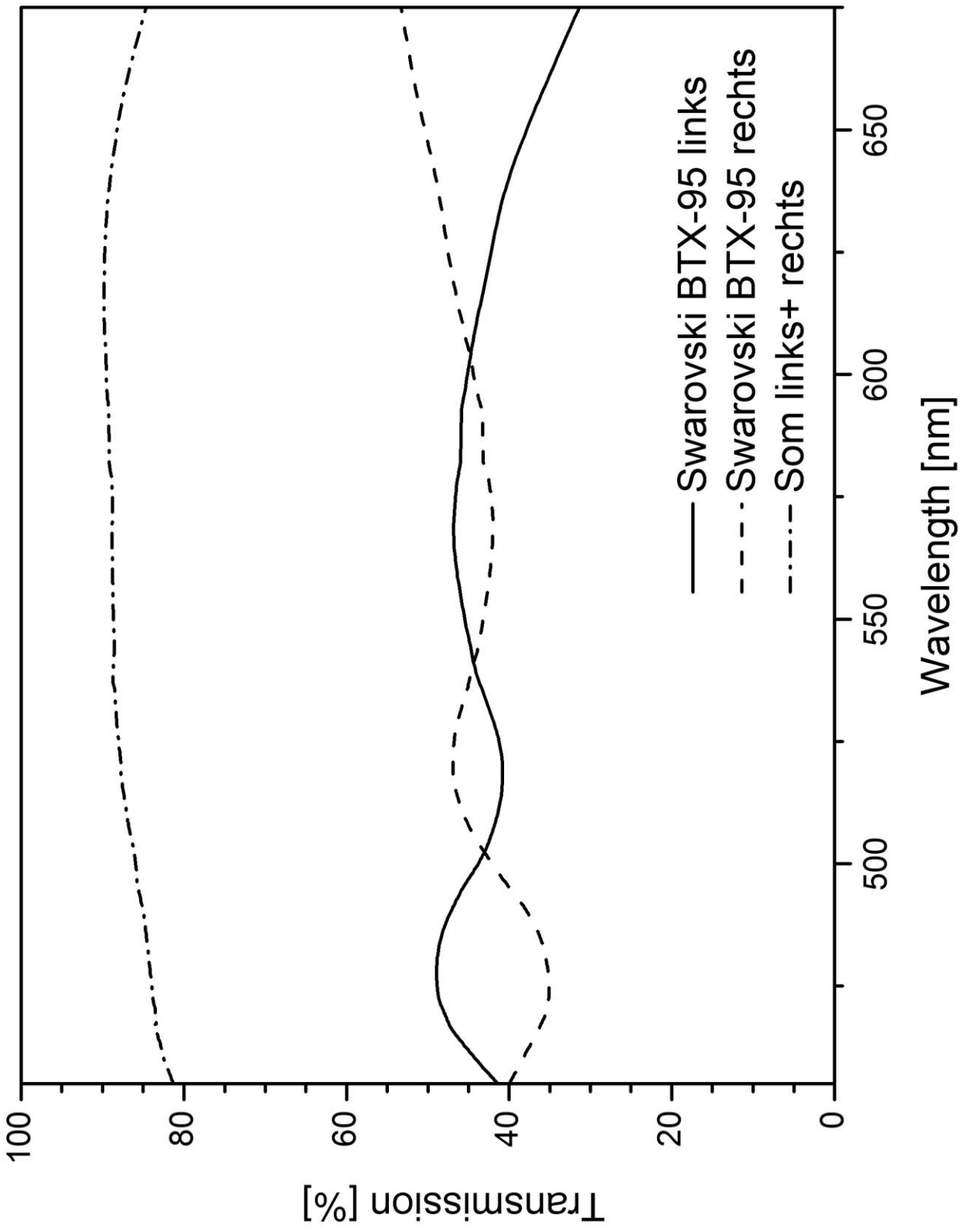
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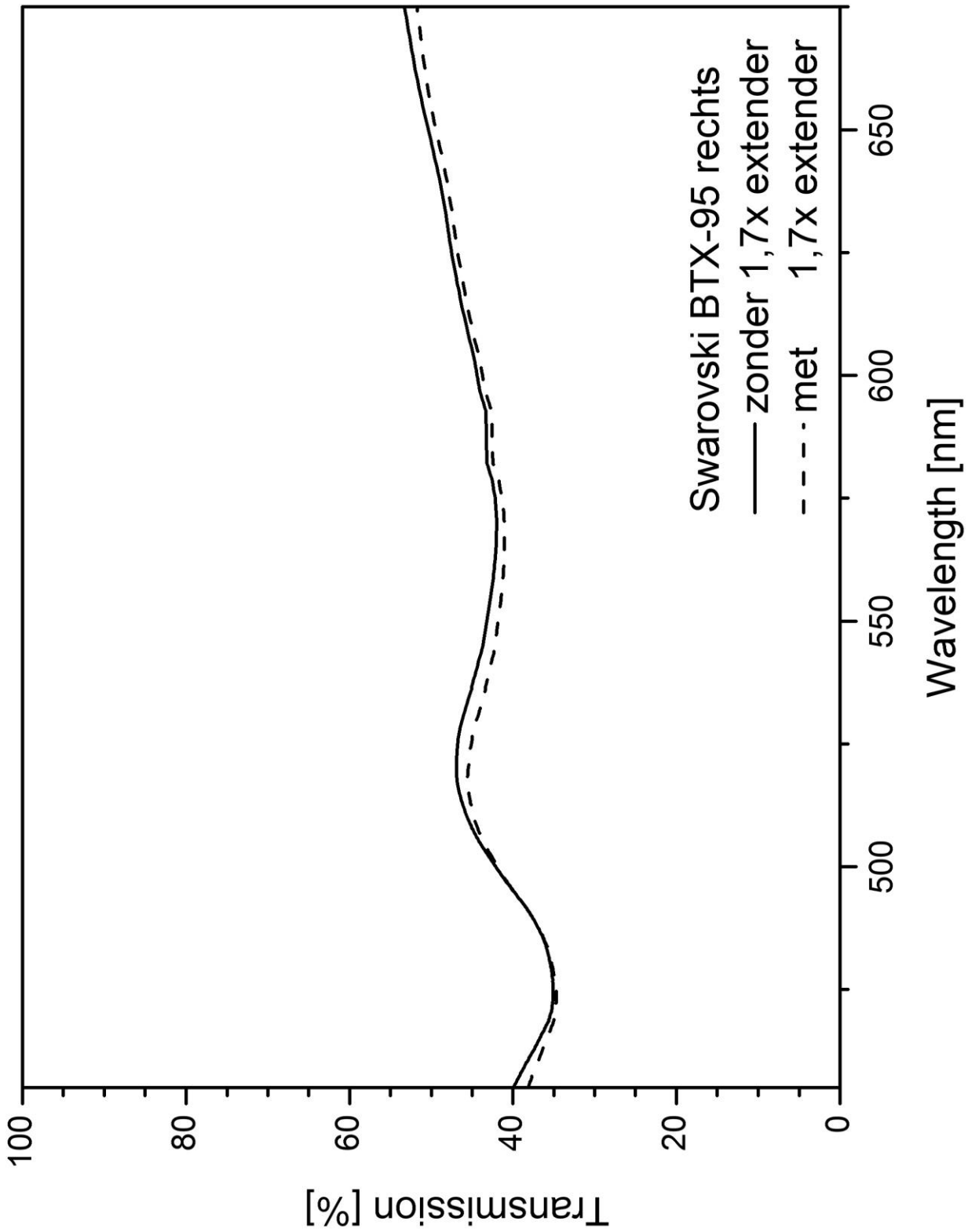
Swarovski BTX-95 links
Swarovski BTX-95 rechts
Som links+ rechts


Swarovski BTX-95 rechts
zonder 1,7x extender
met 1,7x extender
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Wavelength [nm]
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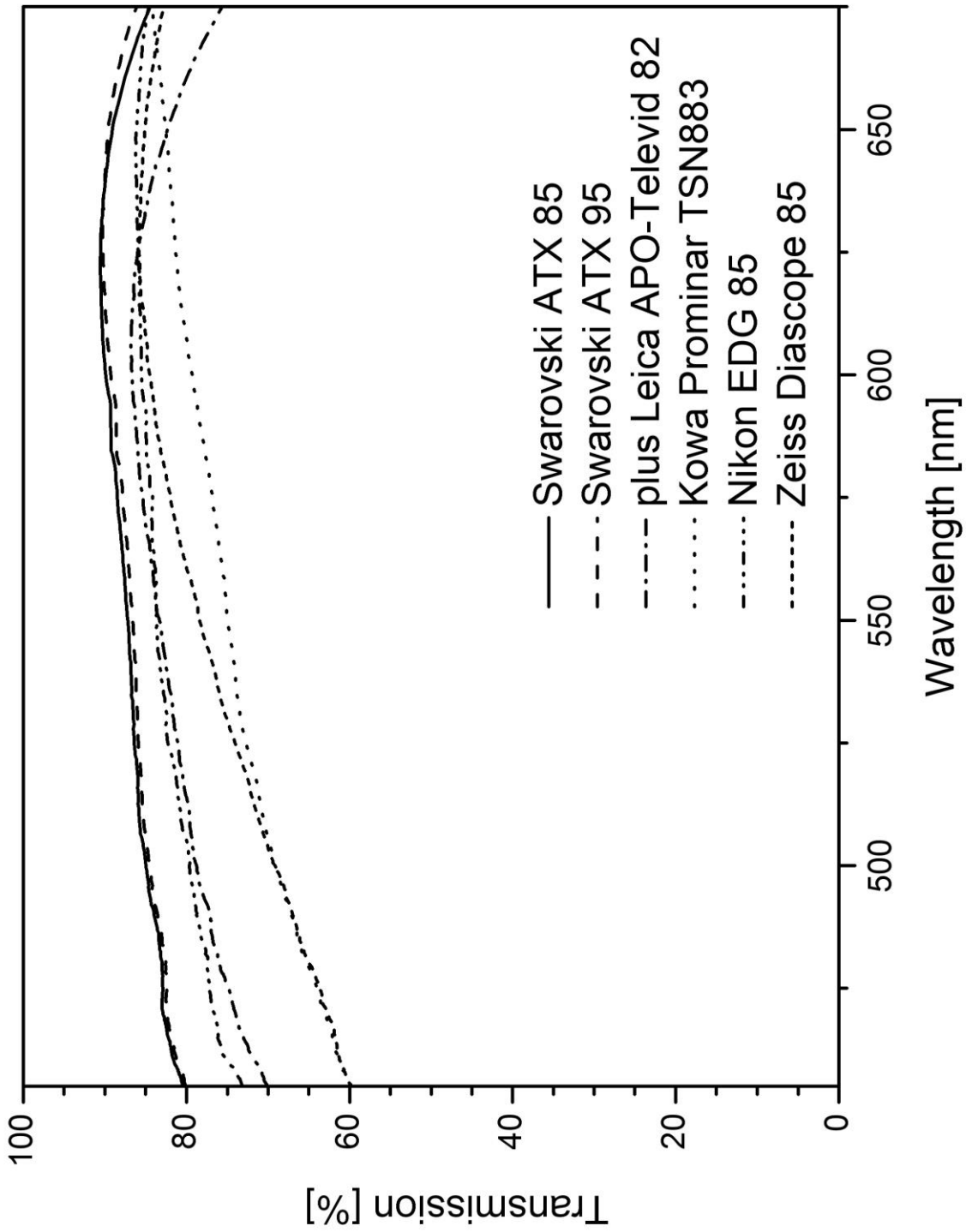
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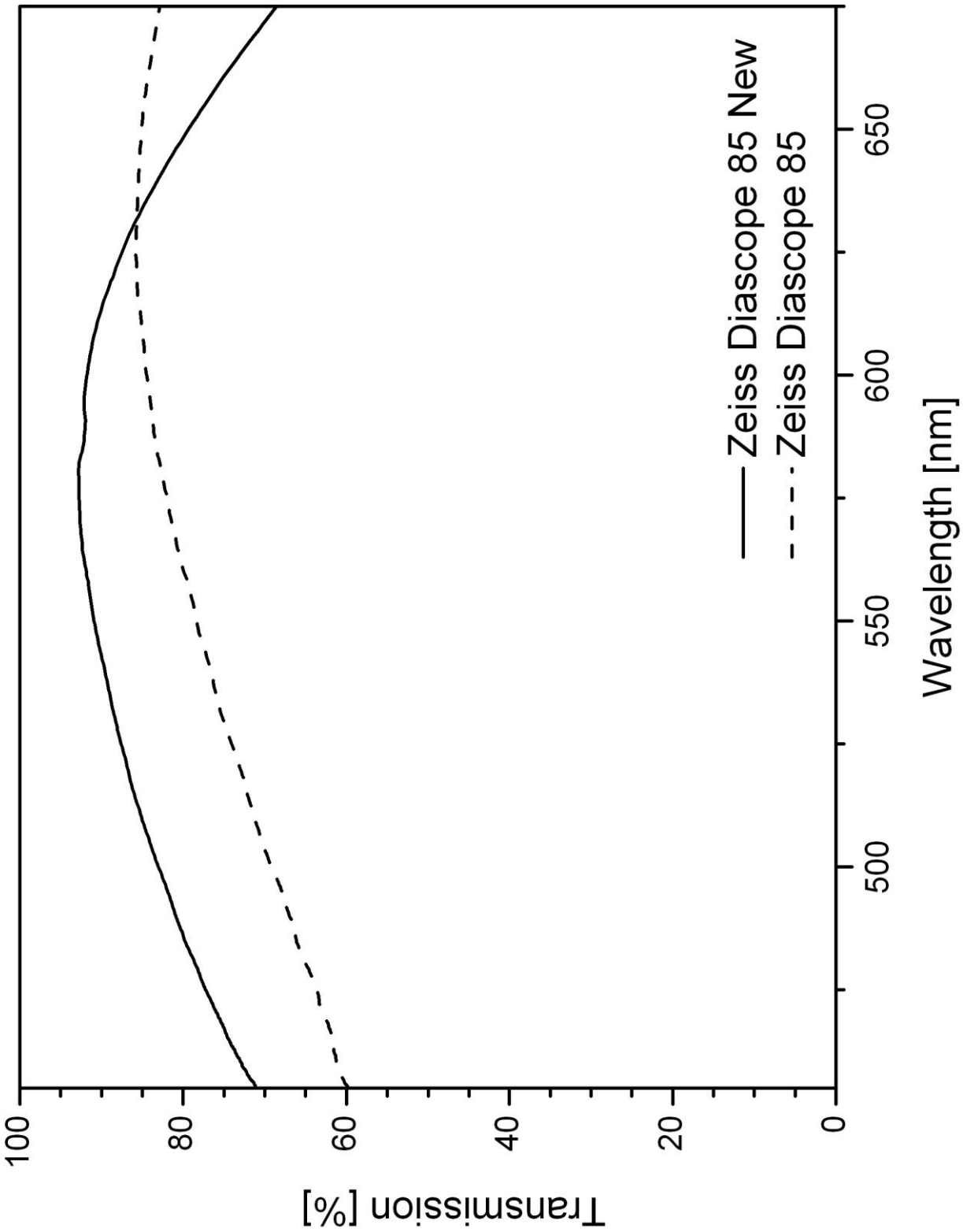
Swarovski ATX 95
plus Leica APO-Televid 82
Kowa Prominar TSN883
Nikon EDG 85
Zeiss Diascope 85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Zeiss Diascope 85 New
Zeiss Diascope 85