

18th century occultation observation by J. H.
Schroeter - early usage
of astronomy's Swiss knife

Konrad Guhl, IOTA/ES



What is a Swiss knife?



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A tool you can accomplish many different jobs with!



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What is the Swiss knife in the astronomy?



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What is the Swiss knife in the astronomy?

Occultation observation !



Who was Johann Hieronymus Schroeter ?



- born in Erfurt 30. August 1745
- lawyer and civil servant (Amtmann)
- from 1782 on he worked in Liliental (near Bremen, Germany) as „Amtmann“ – district gouverneur
- 1782 he start with a small observation station and developed Liliental to a center of European Astronomy. In 1799 instruments are bought by the British king
- main observation → bodies in the solar system especially Moon.
- published in BAJ and a number of own books.
- died 1816 in Liliental

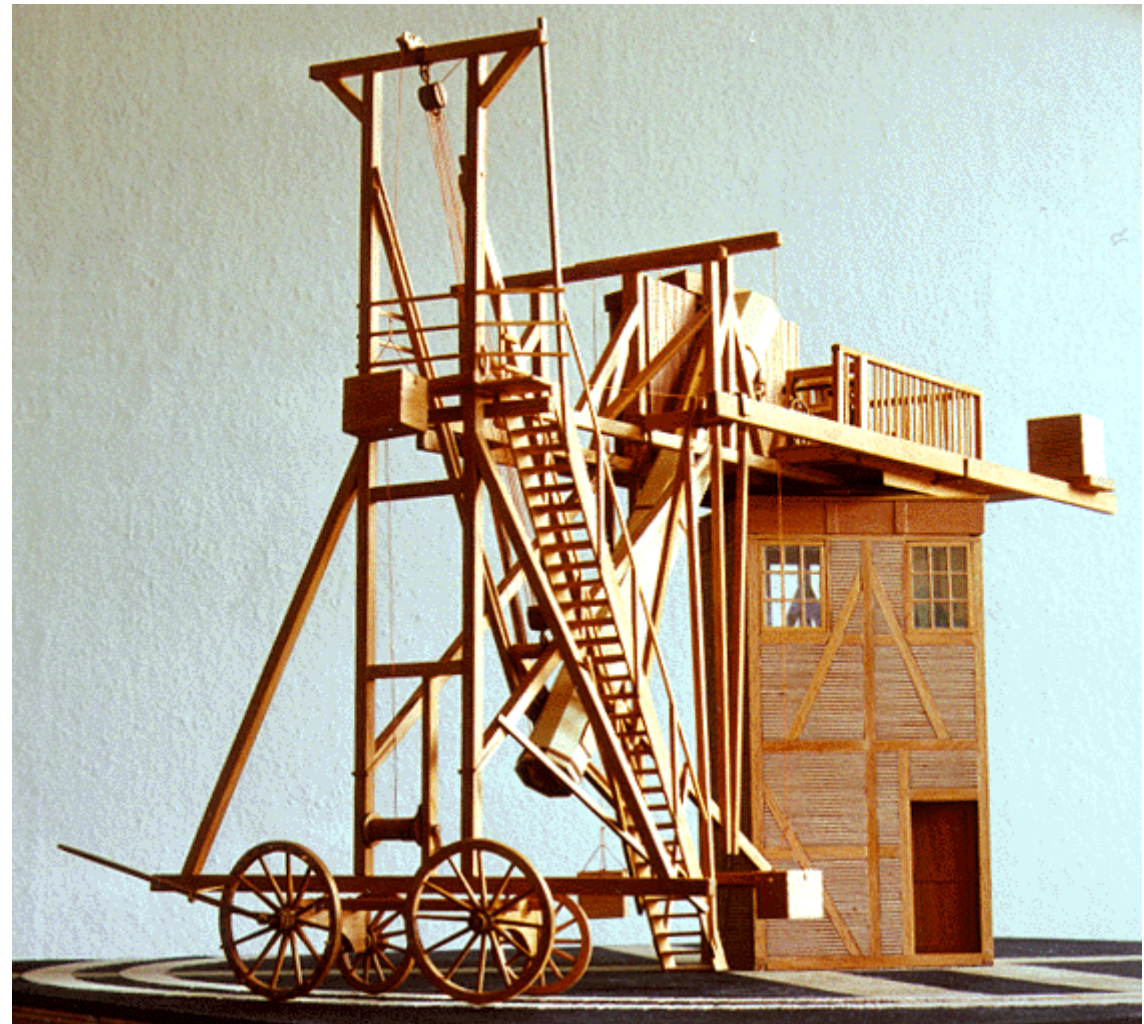
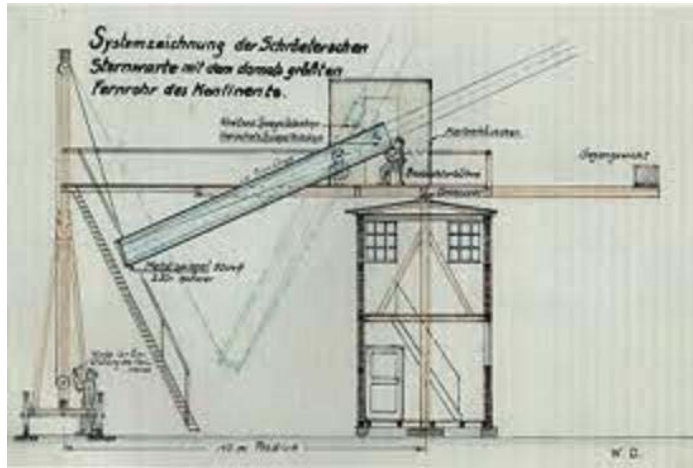


Instruments (typical for the 18th century called to the focal length in feet)

- 50/915 Dollond achromatic lens telescope
- 165/2140 Herschel mirror → 7feet telecope HERSCHEL
- 165/2140 made in Liliental → 7feet SCHRADER
- 240/3960 made in Liliental → the 13feet
- 508/8250 made in Liliental → 27feet „Riesenteleskop“
- 100/3000 lens telescope
- 305/5570 made in Liliental



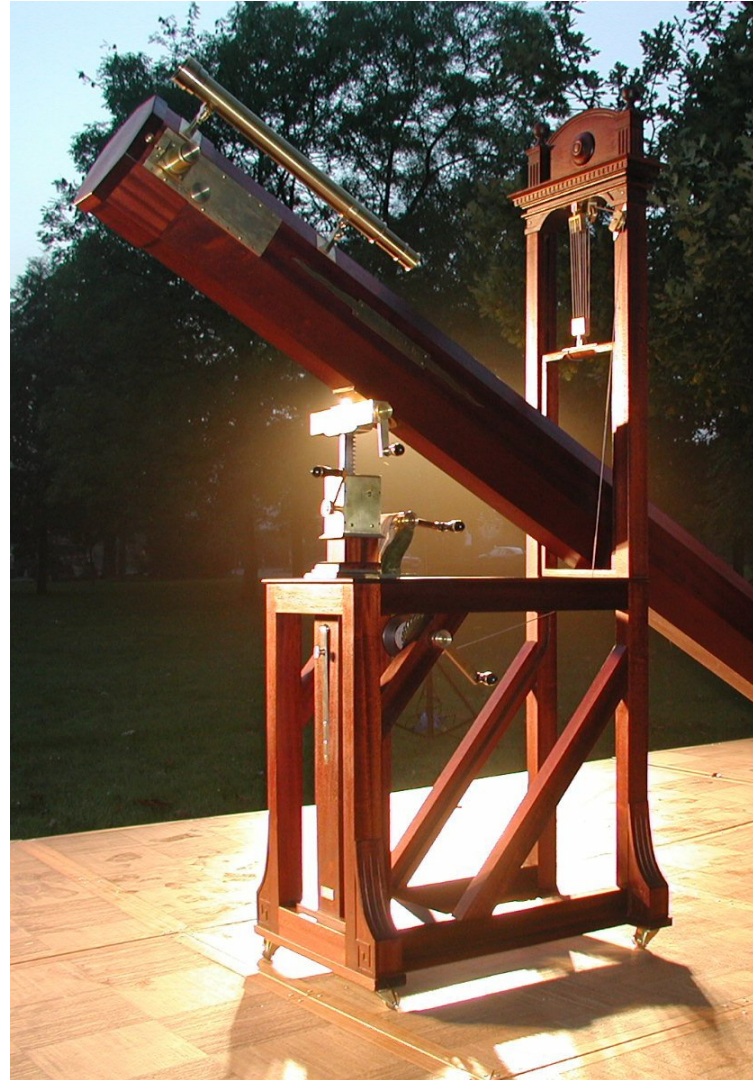
Visit from prince Adolf Friederich, duke of Cambridge on
September 20, 1800



Optical plan and model of the 27feet telescope

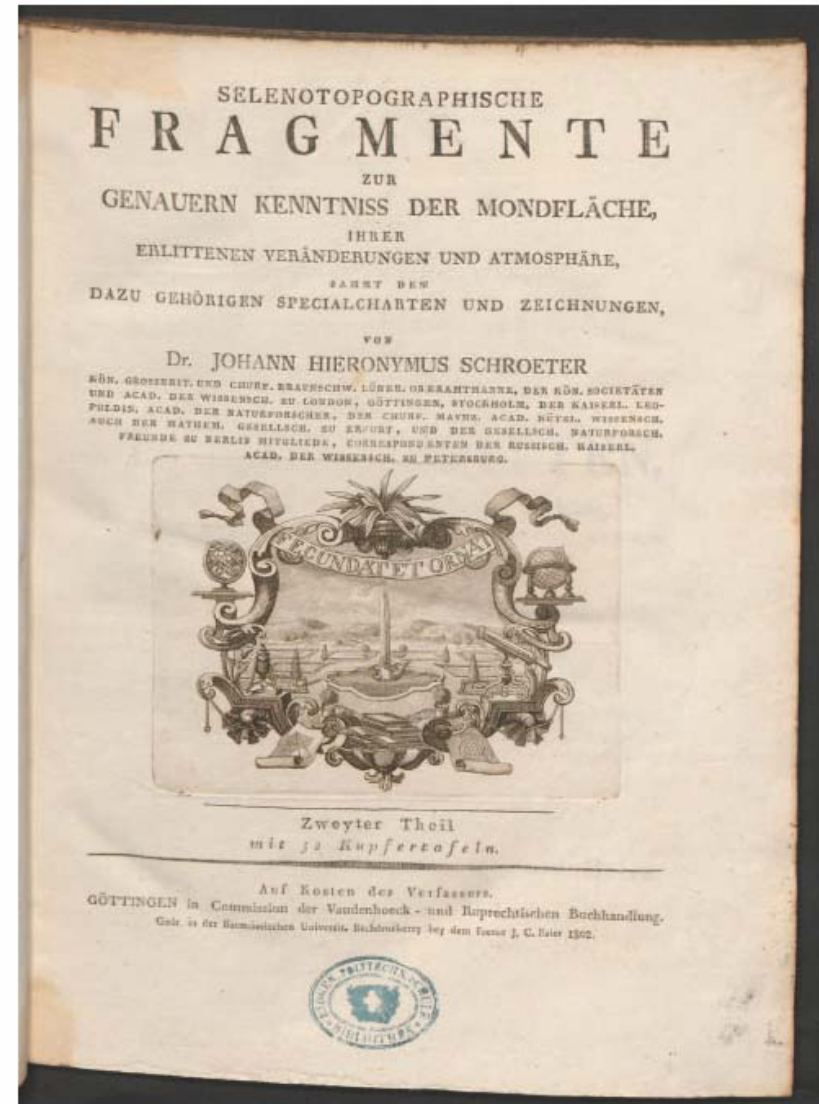


The 7 feet telescope





An extensive part of observation and publishing work – the „selenotopografischen Fragmente“ (1791 and 1802)



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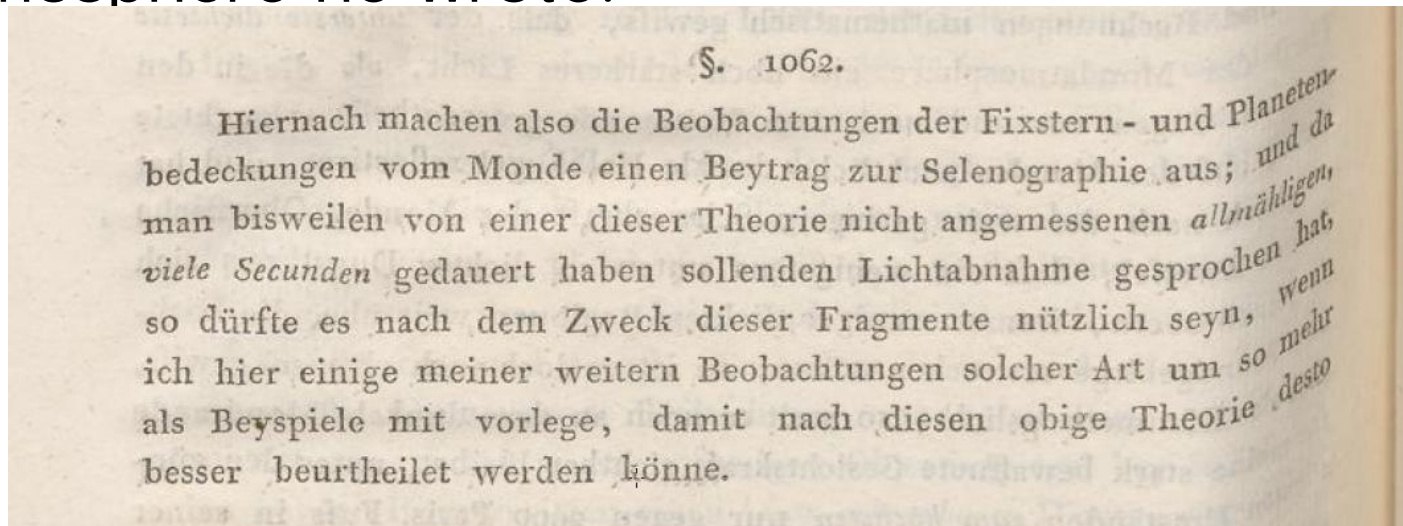
A big part of the publication is the observation and dimension of moons atmosphere.

SCHROETER „belived to see“ the twighlight on the moon and measured the height of the atmosphere to 0.345 miles (earth 8 to 10 miles), the density was found to 1/28 of earths atmospheres density.

Published in part 1 (1791). To give a second proof for the atmosphere he wrote:



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He started observing occultations to prove a theory

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0	05.Sep.1793		Sun	Annular eclipse, "light of twilight"
§1063 1	25.Feb.1792	After 18h	Star 10-12m	Reduction of brightness for 1.5 sec an sudden disappearance→PPM144653 (96Psc) 6.5mag
§1063 2	28.Mar.1792		Telescopic star	Remarkable disappearance →PPM120922 5.0mag
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§1065 6	05.Jan.1794	Before 18h	Small star	..no gradually reduction.. 2 sec in front of moons limb
§1065 7	02.Jun.1794	22h09	Bright star	..no gradually reduction..
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§1066 9	08.Nov.1794	20h06m27,3	Aldebaran	Small clouds, in moment of contact shimmer diverge for 3 sec, than in front of moon,
§1066 9	08.Nov.1794	20h59'31,4	Aldebaran	Reappearance sudden,
§1067 10	23.Sep.1795		Jupiter	Strong szintilation, small "gap" of 2" to the bright limb
§1068 11	14.Mrz.1796	19h37m57,2	Kleiner Stern similar to Dione (10.4m)	2 to 5 sec reduction of brightness, disappear in ½ a little bit smaller than fast as a lightning: → PPM119831 8.8mag
§1068 12	14.Mrz.1796	19h41m24,2	Delta1 Tau	Without light reduction fast as lightning
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§1068 14	14.Mrz.1796	20h24m44,2	Kleiner stern	Became dark, came back for 1 or 1,5 sec. and disappearance fast as lightning→PPM119860 9.5mag
§1068 15	14.Mrz.1796		Delta1 Tau	Reappearance fast without growing light
§1069 16	20.Aug.1796		30Psc	Disappearance on bright limb,
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§1069 17	20.Aug.1796		33Psc	Disappearance on bright limb, no reduction of light,
§1069 17	20.Aug.1796		33Psc	Quick reappearance
§1070 18	21.Okt.1796		Saturn	First contact 2h25m35s, second contact 2h27m19s, no reduction of brightness
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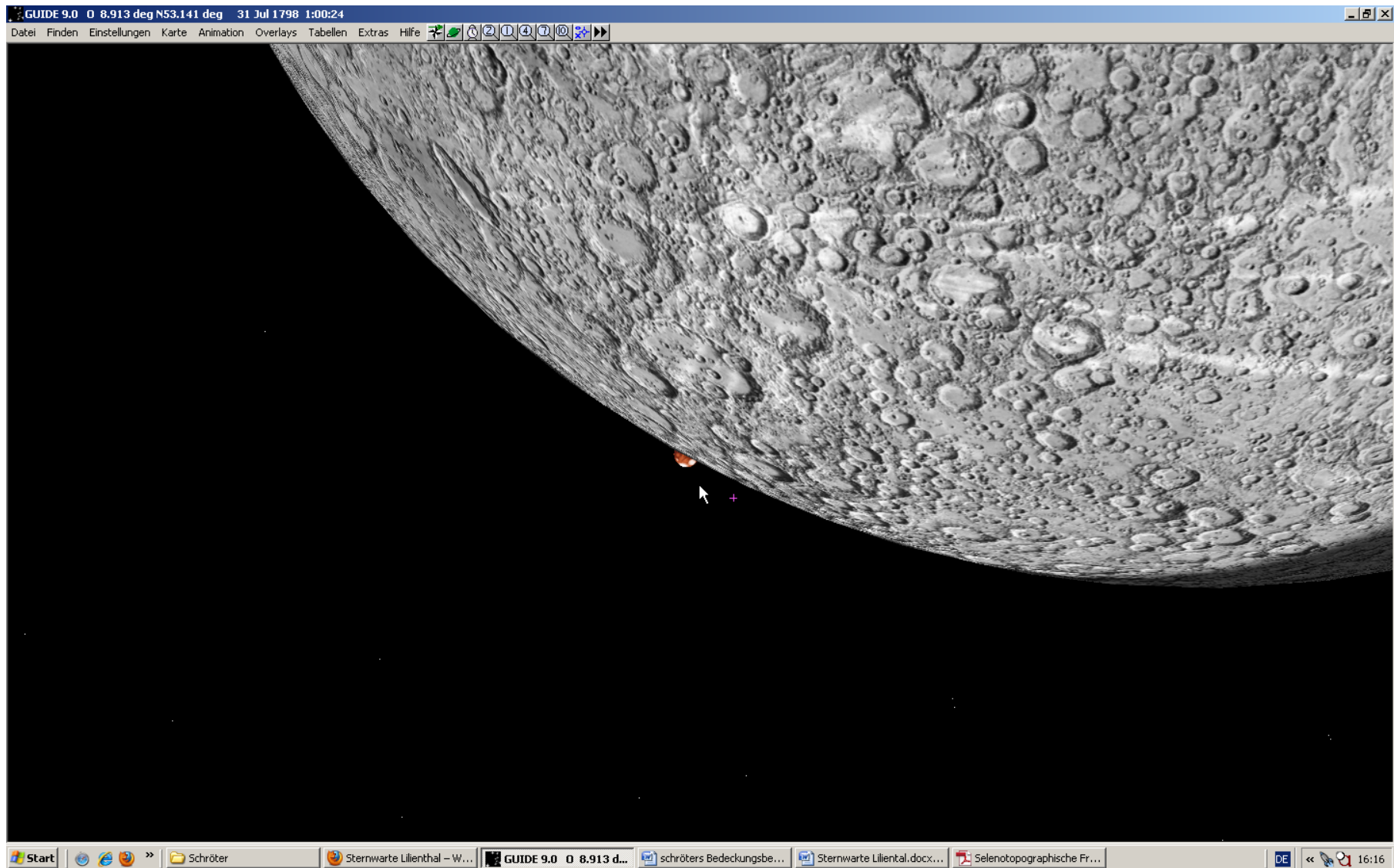
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The Mars – graze:



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Diameter of Aldebaran:

ÜBER DEN DUNSTKREIS DES MONDES etc.

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lich matteres Licht hatte, und ob dagegen derselbe bey dem plötzlichen Austritte, hinter einer Randhöhe und mithin über der dichtesten atmosphärischen Schicht in einer weniger dichten hervorgetreten, und daher sofort augenblicklich bis zu seiner völligen Lichtstärke gelangt sey, bleibt auch hier ungewiß.

Völlig gewiß ist es hingegen nach dieser Beobachtung, *dass*, weil der Mond in einer Sec. Zeit nur $\frac{1}{2}$ Sec. im Raum fortrücket, der Stern aber bey dem Austritte höchstens innerhalb $\frac{1}{2}$ Secunde bis zur völligen Lichtstärke gelangte, Aldebarans Durchmesser nicht über eine Viertelsecunde betragen könne. Eher dürfte indeß sein Durchmesser noch etwas kleiner seyn, weil er gleich einem Blicke bis zum völligen Glanze, und nach der eigentlichen Schätzung innerhalb $\frac{1}{4}$ nur höchstens in $\frac{1}{2}$ Secunde vorbeblinke.



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The results to prove the atmosphere:

25 observations from 1793 till 1798.

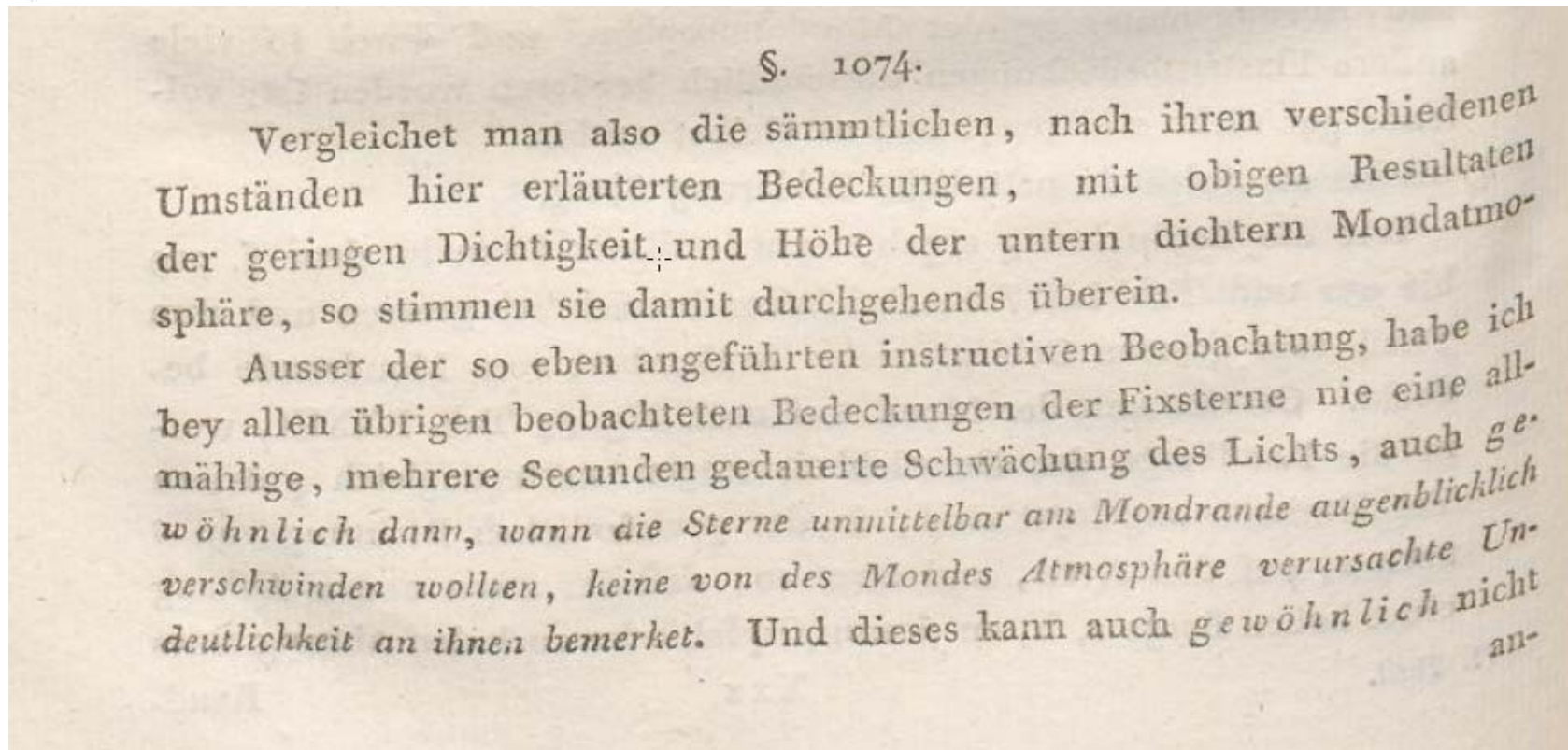
Including a solar eclipse, occultation of Jupiter, Saturn and Mars (graze) also Aldebaran

For 23 observations the comments show no indication for an atmosphere.

Only the eclipse „light of twilight“ and the occultation of PPM 267044 is commented as prove for the lunar atmosphere.



Although the (wrong) conclusion:



→ These observations are a „proof“ !!



How SCHREOTER explains the (negative) result

- Lunar atmosphere only 0.36" over moons limb.
- Only in valley areas the atmosphere can influence the light of a star
- In mountain areas or for big objects like planets no influence is visible
- Only small stars are influenced.



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- Lunar atmosphere only 0.36" over moons limb.
- Only in valley areas the atmosphere can influence the light of a star
- In mountain areas or for big objects like planets no influence is visible
- Only small stars are influenced.
- The atmosphere was discovered in part 1 (1791) of STF but the „proof“ was published in part 2 (1802).



Thanks !