

IX. *Observations and Remarks on those Stars which the Astronomers of the last Century suspected to be changeable. By Edward Pigott, Esq.; communicated by Sir Henry C. Englefield, Bart. F. R. S. and A. S.*

Read February 9, 1786.

IT is about a century since HEVELIUS, MONTANARI, FLAMSTEED, MARALDI, and CASSINI, noticed a certain number of stars which they supposed had either disappeared, changed in brightness, or were new ones; and yet to this day we have acquired no further knowledge of them. This may be attributed to the difficulty of finding out what star is meant, and the not having exact observations of their relative brightness. I therefore have drawn up the following catalogue, and made the necessary observations; so that in future we can examine them without much trouble, and be certain of any change that may take place. To accomplish this, it was requisite to compare with attention many authors and most of the catalogues of stars; in doing which I have perceived several undoubted errors, and others highly probable; but as entering into a discussion of such disagreements would swell this account considerably, and make it very intricate, I shall avoid, as much as possible, any thing of the kind that is not immediately necessary.

In order to separate certainty from doubt, I have classed these stars in two divisions; the first are undoubtedly changeable;
the

the others remain yet to be better authenticated. Though some of them bear all the appearance of being variable, still no *certainty* of their being so has come to my knowledge. To those of the first class are subjoined observations made on them within these last four years, from which the period and progressive changes of some are deduced, though never settled before, and if already known are more exactly determined by comparing my observations with former ones. Also, as the position of several are determined only by ancient astronomers, and therefore inaccurately, I have observed them with great exactness, the declinations being taken with a BIRD's eighteen-inch quadrant, and the right ascensions with a three-feet transit instrument: these last may serve in future to discover their proper motions in right ascension, for which reason I shall specify the stars to which they were compared. The stars of the second class have either their relative brightness exactly settled, or their non-existence ascertained. I have also pointed out the probability of a mistake in several, and in general given an account of the appearance they have had within these few years.

Catalogue of variable Stars, reduced to the beginning of 1786.

Class the first.

Names.	R. A. in time.			Declination.			Greatest and least magnitudes.	From whence reduced.
	h.	'	"	°	'	"		
Nova 1572, in Cassiopea,	00	13	00	—	62	58	+ N	1 — 0 { RICCIOLUS's Almagestum, &c.
♂ Ceti	2	8	33		3	57	25 S	2 — 0 BRADLEY.
Algol	2	54	19		40	6	55 N	2 — 4 MAYER.
MAYER's 420th in Leo	9	36	5		12	25	00 N	6 — 0 MAYER.
In Hydra	13	18	4+		22	9	38 S	4 — 0 From my observat.
Nova 1604 in Serpentarius	17	18	00	—	21	10	$\frac{1}{2}$ S	1 — 0 Phil. Tr. N° 346.
♂ Lyre	18	42	11		33	7	46 N	3 — 4.5 BRADLEY.
Near the Swan's head	19	38	58		26	48	$\frac{1}{2}$ N	3 — 0 Phil. Tr. N° 65.
♂ Antinoi	19	41	34		00	28	14 N	3.4 — 5 LA CAILLE.
In the Swan's neck	19	42	21	—	32	22	58 N	5 — 0 From my observat.
In the Swan's breast	20	9	54		37	22	37 N	3 — 0 From my observat.
♂ Cephei	22	21	00		57	20	00 N	4.3 — 4.5 FLAMSTEED.

Class the second.

HEVELIUS's 6 Cassiopeæ	00	23	16		60	50	00 N	7 — 0	HEVELIUS.
46 or ξ Andromedæ	1	9	46		44	24	00 N	4.5 — 5.6	FLAMSTEED.
50 or υ Andromedæ	1	24	16		40	20	15 N	4.5 — 0	FLAMSTEED.
HEVELIUS's 41 Androm.	1	28	40		41	31	$\frac{1}{4}$ N	5 — .	HEVELIUS.
TYCHO's 20th Ceti	1	39	.		13	20	. S	5 — 0	TYCHO.
55 or Neb. Andromedæ	1	40	30		39	40	3 N	6 — .	FLAMSTEED.
PTOL. and UL. BEIGH } σ Eridani	2	42	.		9	40	. S	4 — 0	UL. BEIGH.
41 Tauri	3	53	27		27	00	39 N	5 — 0	FLAMSTEED.
47 Eridani	4	23	54		8	41	40 S	4 — 0	FLAMSTEED.
Near 53d Eridani . . .	4	29	00		12	30	± S	4 — 0	By estimation.
γ Canis Majoris.	6	54	5		15	19	36 S	3 — 0	LA CAILLE.
β Geminorum	7	32	11+		28	31	38 N	1 — 3	MASKELYNE.
ξ Leonis	9	20	24		12	14	23 N	4 — 6	MAYER.
↓ Leonis	9	32	3		14	59	36 N	5.6 — 0	MAYER.
25th Leonis	9	46	8		12	20	36 N	6.7 — 0	FLAMSTEED.
BAYER's ι Leonis . . .	9	52	$\frac{1}{2}$		15	30	. N	6 — 0	TYCHO.
♂ Ursæ Majoris	12	4	45		58	13	24 N	2 — 4	LA CAILLE.

Class the second continued.

Names.	R. A. in Time.	Declination.	Greatest and least magnitudes.	From whence reduced.
	h. ' "	° ' "		
α Virginis	12 7 43	00 24 16 N	6 0	MAYER.
BAYER's * near γ η	12 53 00	10 00 . S	6-0	From maps.
In N. thigh of Virgo	13 29 +	00 30 . S	6-0	From maps.
ρ Virginis	13 43 43	2 5 50 N	6-0	FLAMSTEED.
α Draconis	13 58 36	65 24 8 N	2-4	BRADLEY.
In west scales of Libra	14 53 $\frac{1}{2}$	13 26 . S	6-0	{ Mém. de l'Acad. des Sciences.
PTOL. and UL. BEIGH's } 6th unformed in Libra	15 29 +	20 30 . S	4-7	UL. BEIGH.
* Libræ	15 29 39	19 58 27 S	4- .	LA CAILLE.
TYCHO's 11th Libræ	15 37 $\frac{1}{2}$	19 30 . S	4-0	TYCHO.
33 Serpentis	15 38 00	17 14 00 N	6-0	FLAMSTEED.
Near ϵ Urxæ Minoris	16 $\frac{1}{4}$.	82 $\frac{3}{4}$. N	6-0	From maps.
PTOL. 14 Ophiuchi	17 2 14	26 15 37 S	4-0	BRADLEY.
PTOL. 13 Ophiuchi	17 18 +	20 35 . S	4-0	PTOL.
PTOL. 18 Ophiuchi	17 22 .	24 10 . S	5-0	PTOL.
σ Sagittarii	18 42 00	26 32 34 S	2-4	MAYER.
θ Serpentis	18 45 35	3 56 26 N	4-5	LA CAILLE.
TYCHO's 27th Capricor.	21 41 .	14 28 . S	6-0	TYCHO.
TYCHO's 22d Androm.	21 43 $\frac{1}{2}$	49 15 . N	4-0	TYCHO.
TYCHO's 19 Aquarii	22 25 .	15 55 . S	6-0	TYCHO.
σ Andromedæ . . .	22 52 6	41 10 45 N	4-6	LA CAILLE.
LA CAILLE's 483 } Zodi. Cat. . . .	22 55 40	8 50 45 S	7-0	LA CAILLE.

I shall now proceed to give a short account of these stars, and begin with those of the first class.

The famous Nova of 1572 in Cassiopea.

Several astronomers are of opinion, that it has a periodical return, which KEILL and others have conjectured to happen every 150 years. This is also my opinion; and I cannot think its not being noticed at the completion of every term a material

rial objection, since perhaps, as with most of the variables, it may at different periods have different degrees of lustre, so as sometimes to increase only to the ninth magnitude; and if this be the case, its period is probably much shorter. This induced me, in September 1782, to take a plan of the smallest stars near its place, and which I have examined often since, but found no alteration.

o Ceti.

Since the end of 1782 I have observed very exactly the decrease of brightness of this star; but never have seen it of above the 6th magnitude. Oct. 29, 1782, it was of the 7th magnitude, and gradually decreased till Dec. 30, it being then of the 8 . 9th magnitude.

1783, Feb. 16, certainly less than the 9th magnitude.

1783, August 25, of the 6th magnitude, and gradually decreased until Dec. 14, being then of the 10th magnitude, and equal to the little star close to it.

1784, Jan. 11, I thought it by intervals still less than the same little star.

1784, Sept. 12, it was of the 7 . 8th magnitude, and gradually decreased until Dec. 9, and then was of the 9th magnitude, and rather brighter than the little star.

As a matter of curiosity, I have deduced its period from the times when it was equal to a certain star in the course of its decrease; the results were 320—337 and 328 days; but M. CASSINI determined its mean period with greater exactness to be 334 days. Mr. GOODRICKE saw it Aug. 9, 1782, of the 2d magnitude, rather brighter than α and less than β Ceti. Sept. 5, it was of the 3d magnitude, being equal to γ Ceti.

Algol.

The period of Algol, discovered by Mr. GOODRICKE, gave us some new light into the nature of the fixed stars. Though the phænomena seem to attract the attention of most astronomers, still there are some points which require further investigation. Its degree of brightness, when at its *minimum*, is different in different periods; and also, I think, when at its full, it is sometimes brighter than α Persei, and at other times less. Whether these differences return regularly after a certain number of periods remains yet to be examined. My last observations, when it was at the middle of its *minimum*, are,

- h. ,
- 1785, July 8, at 11 50 undoubtedly less than ϵ Persei.
 — July 31, at 9 50 equal to ϵ Persei.
 — Sept. 12, at 10 45 { a remarkable observation ; rather less than δ Persei ;
 evidently brighter than ϵ ; nearly of the 3d mag.

MAYER's N° 420, lately discovered to be variable by M. KOCH.

A few years before 1782, M. KOCH saw the N° 420 undoubtedly less than the N° 419 of MAYER's Catalogue.

In February 1782, he found them both exactly of the same brightness, therefore of the 7th magnitude.

From an extract of a letter I have lately seen, the variable was of the 9th magnitude in April, 1783, and of the 10th in April, 1784.

I have often seen the N° 419, but never the variable, though I have frequently looked for it with a night-glass, and on the 4th of April, 1785, in a 3-foot achromatic transit instrument.

Variable in Hydra.

MARALDI, in 1704, having found that this star had a periodical variation, continued to examine it for several years, and concluded its period to be about two years, though with considerable variations; in which he was much mistaken, as will appear from the following results, which shew that its period in all probability is tolerably regular, and only of 494 days.

Dates when it was at the middle of its greatest brightness, estimated from MARALDI's observations.

1704, March 14, he saw it nearly of the same magnitude from the beginning of March until the beginning of April; it then decreased.

1705, . . . he saw it very faint in November, 1705, and found it decreasing: this observation is too imperfect.

1708, May 22, accurately determined; its increase and decrease being well observed.

1709, Nov. 10, :: doubtful, its decrease only being observed.

1712, May 1, :: ditto, ditto, ditto.

1784, Jan. 26, by me, very accurately, its increase and decrease being observed. See the Observations that conclude this paper.

1785, May 27, ditto, ditto, ditto.

The four greatest intervals of MARALDI's Observations give for single periods in days thus 495—517—480 and 510, the mean being $500\frac{1}{2}$, which is tolerably exact considering how

doubtful the observations of 1709 and 1712 are. My two make it 487 days; but as the interval is only a single period, it may err 10 days; I therefore shall take a mean between the results, which is 494, and proceed on to the following comparisons of MARALDI's two best observations with mine.

1708, May 22,	}	interval of 56 periods, each of $493\frac{2}{3}$ days.
1784, Jan. 26,		
1708, May 22,	}	interval of 57 periods, each of $493\frac{1}{2}$ days.
1785, May 27,		
1704, Mar. 14,	}	interval of 59 periods, each of $494\frac{1}{2}$ days.
1784, Jan. 26,		
1704, Mar. 14,	}	interval of 60 periods, each of $494\frac{1}{5}$ days.
1785, May 27,		

A single period, on a mean, 494 days.

If MARALDI's observations of 1704 and 1708 are exact to a month, and there is no reason to believe otherwise, the period at that time seems to have been a few days longer than it is at present, and therefore the one here deduced may be esteemed as the mean period.

Particulars of the changes it undergoes.

1. When at its full brightness it is of the 4th magnitude, and has no perceptible change for about a fortnight.
2. It is about six months in increasing from the 10th magnitude, and returning to the same.
3. Therefore it may be considered as invisible also during six months.
4. It is considerably quicker in increasing than in decreasing, perhaps by half.

Though

Though when at its full it may always be filed of the 4th magnitude, it does not constantly attain exactly the same degree of brightness, but the differences are very small, as shewn below.

1704, brighter than ψ .		1784, { much brighter than ψ , being nearly between ψ and γ Hydræ.
1708, brighter than ψ .		1785, rather brighter than ψ .

Its mean right ascension, computed from my observations, and reduced to Jan. 1, 1784, is

° ' " { from 4 observations, compared to ζ μ , made between March
199 29 30 { and May 1784.

199 29 21 from 2 ditto, compared to MAYER's 538, made in May, 1784.

199 29 20 from 5 ditto, compared to γ Hydræ, made between March and May, 1784.

199 29 24 — mean right ascension for Jan. 1, 1784, on a mean.

HEVELIUS's 30th Hydræ is the above star; he marks it of the 6th magnitude; I find it in no other Catalogue.

The famous Nova of 1604, in Serpentarius.

A full account of this star is given by KEPLER, and it seems to have had a similar appearance to the Nova in Cassiopea; therefore the reflections delivered there need not be again repeated. In July, 1782, I took a plan of the smallest stars near its place, which was examined every year since, but no alteration was perceived.

β Lyræ.

Mr. GOODRICKE discovered the variation and period of this star, and hopes soon to settle its different phases with more exactness;

exactness; I shall therefore not enter into any detail, being certain it cannot be in better hands. In his last account he mentions having first suspected the period to be only of six days nine hours; such has always been my opinion, and which material point will probably be more satisfactorily determined in his next publication.

Nova near the Swan's Head of 1670.

This star was first seen in December 1669 by Don ANTHELME; it soon became of the 3d magnitude, and disappeared in 1672, after having undergone several variations. I have constantly looked for it since November, 1781, without success; had it increased to only the 10th or 11th magnitude, I should have perceived it, having taken an exact plan of all the surrounding stars.

η Antinoi.

The variation and period of this star I discovered last year, and had the honour of communicating an account of it to the Society: as at present a long interval is elapsed since my first observations, and that lately I have noted some of its phases with exactness, I shall compare them to those observed in 1784, which of course will give results more satisfactory. The period, as settled in my former paper, is 7 d. 4 h. 38'; but for reasons there alledged, it must be much less precise than the following.

1785, July 18, at 9 h.	} times when η Antinoi was between its least and greatest brightness.
Sept. 6, at 18	
Sept. 27, at 22	

These being compared to similar observations of Sept. 12 and 19, 1784, make the length of a single period thus :

D.	H.	M.
7	4	12
7	4	19
7	4	17
7	4	22
7	4	7
7	4	12
<hr/>		
7	4	15 on a mean.
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I see no reason to alter materially the other points; but believe them more exact thus :

40 hours at its greatest brightness.

66 — in decreasing.

30 — at its least.

36 — in increasing.

It also, in every period, seems to attain the same degree of brightness when at its full, and to be equally decreased.

Variable in the Swan's Neck.

During these three years I have observed this star with particular attention, as may be seen by the observations that conclude this Paper, and determined the middle time of its greatest brightness very exactly, thus :

1783, July 9, of the 6 . 7th magnitude.

1784, Aug. 4, of the 5 . 6th ———

1785, Sept. 1, of the 6th ———

The second of these, being compared to that of Nov. 20, 1687, made by KIRCH, gives 406 days exactly for one period, the interval between them being 35322 days, and divided by 87 periods. I make the divisor 87, in order to get a result nearest to that settled by MARALDI and CASSINI of 405, and by M. LE GENTIL of 405,3 days. We cannot suppose that these great astronomers have made any mistake; and on the other hand, it seems hardly possible, that the mean of my observations alone, which makes the period 392 days, can err 14; but perhaps its period is irregular; to determine which several intervals of 15 years ought to be taken, and I am much inclined to believe, that it will be found of only 396 days 21 hours.

Particulars of the changes it undergoes.

1. When at its full brightness it has no perceptible change for about a fortnight.

2. It is about $3\frac{1}{2}$ months in increasing from the 11th magnitude to its full brightness, and the same in decreasing.

3. Therefore it may be considered as invisible during six months.

4. It does not attain the same degree of brightness at every period, being sometimes of the 5th, and other times of the 7th magnitude.

Its mean right ascension, computed from my observations, and reduced to Aug. 1, 1783, is

- 295 33 46 from 2 observ. compared to γ Cygni, made in July and August, 1783.
 295 33 45 from 2 ditto, compared to γ Lyræ, ditto.
 295 33 45 from 1 ditto, compared to α Lyræ, made in August, 1783.
 295 33 55 from 3 ditto, compared to β Lyræ, made in July and August, 1783.
 295 33 52 from 2 ditto, compared to β Cygni, made in August 1783.

 295 33 $48\frac{1}{2}$ mean right ascension for August 1, 1783, on a mean.

Variable in the Swan's Breast.

This star was first seen by G. JANSONIUS in 1600, and afterwards frequently observed by different astronomers, but with intervals of ten or more years, which is probably the reason why no regularity in its changes has yet been deduced. I have examined minutely the observations made in the last century, and shall venture to give the following results.

1. Continues at its full brightness for about five years.
2. Decreases rapidly during two years.
3. Invisible to the naked eye for four years.
4. Increases slowly during seven years.
5. All these changes, or its period, are completed in 18 years.

6. It was at its *minimum* at the end of the year 1663.

It does not always increase to the same degree of brightness, being sometimes of the 3d, and at other times only of the 6th magnitude. I am intirely ignorant whether it is subject to the same changes since this century, having not met with any series of observations on it; but if the above conjectures are exact, it will be at its *minimum* in a very few years. Since November, 1781, I have constantly seen it of the 6th magnitude, being rather less than N° 28, 29, and *m*, and rather brighter than

36 and 40 Cygni. Sometimes I suspect it has rather decreased within these two last years, though in a very small degree.

Its mean right ascension, computed from my observations, and reduced to Sept. 1, 1782, is

302 26 43 from 3 observations, compared to γ Cygni, made in October, 1781.

302 26 46 from 3 ditto, compared to γ Cygni, made in August, 1782.

302 26 52 from 1 ditto, compared to β Aquilæ, made ditto.

302 26 46 from 1 ditto, compared to α Cygni, made ditto.

302 26 39 from 1 ditto, compared to δ Andromedæ, made in October 1781.

302 26 45 mean right ascension for Sept. 1, 1782, on a mean.

FLAMSTEED has this star in his Catalogue; but, I believe, observed it only once.

δ Cephei.

This is the last variable star discovered, and again by Mr. GOODRICKE. Its changes are very difficult to be seen, unless examined when at its *minimum* and full brightness. I have lately made some good observations on it thus:

1785, Aug. 30, at 14 h. less than ϵ Cephei.

31, at 9 h. equal if not brighter than ζ Cephei.

Sept. 15, at 12½ h. less than ϵ Cephei.

16, at 8 h. between ϵ and ζ Cephei.

— at 11 h. increased, but not as bright as ζ .

17, at 11 h. rather brighter than ζ .

26, at 11½ h. equal or less than ϵ .

27, at 8 h. evidently brighter than ζ .

Therefore it was between its least and greatest brightness August 31, at noon, and Sept. 26, at 21 h.: these being compared to *my* first observations, when also between its least and greatest brightness on Nov. 20, at 3 h. and Nov. 30, at 15 h.

1784,

1784, give the following results, the mean of which corroborates that deduced by Mr. GOODRICKE of 5 d. 8 h. 37 $\frac{1}{2}$.

D. H. M.

5 8 35

5 8 41

5 8 33

5 8 39

Length of a single period 5 8 37 on a mean.

δ Cephei concludes the stars of the first class; those that follow are of the second.

HEVELIUS's 6th Cassiopeæ.

In 1782 I first perceived that this star was missing; nor could I find it in 1783 and 1784.

46th or ξ Andromedæ.

This star is said to have diminished in brightness. In 1784 and 1785 I found it, by very exact observations, less than ν , equal to ω^* , and brighter than d and χ ; yet I must mention that it is marked in my journal as being sometimes brighter, and at other times less than ω^* ; but still I am not convinced, that it varies in brightness. FLAMSTEED, in his Catalogue, annexes no character to his 46th Andromedæ; but in vol. II. of his Hist. Cœlest. p. 135. and 138. he marks it ξ .

* I suspect an error in this character, but cannot be certain. H. E.

FLAMSTEED'S 50, 52, τ Andromedæ, and HEVELIUS'S 41 Andromedæ.

As the position and characters of these stars differ considerably in different Catalogues, and that some of them are mentioned by CASSINI to have disappeared and re-appeared, I shall give their brightness as observed in 1783, 1784, and 1785.

FLAMSTEED'S 50th of the 4.5th magnitude, and equal, if not rather less than ϕ Andromedæ.

———— τ of the 5th magnitude, and equal to 46 and 48 Andromedæ.

————	49	} of the 5.6th magnitude, and are of the same brightness.
————	52	
HEVELIUS'S	41	

A star between FLAMSTEED'S 52 and HEVELIUS'S 41 is of the 6th magnitude, or rather less. I could not see TYCHO'S 19th Andromedæ; but I take this star to be the same as HEVELIUS'S 41 Andromedæ.

TYCHO'S 20th Ceti.

This must be the star which HEVELIUS said had disappeared, being TYCHO'S second in the Whale's belly. There can hardly be any doubt but that it is the χ , misplaced by TYCHO. This χ is of the 4.5th magnitude, and of the same brightness as the three ψ Aquarii.

FLAMSTEED'S 55th Andromedæ, marked Neb. in his Catalogue.

It is mentioned in the latest Catalogues of Nebulæ that this nebula could not be found. FLAMSTEED, who, I believe,

only observed it once, *viz.* Oct. 17, 1691, does not mark it nebulous; nor does it appear to me such, but as a star of the 6th magnitude. There are a few small stars near it, which to the naked eye, when the air is very clear, make it appear nebulous, which probably is the reason why FLAMSTEED marked it thus in his Catalogue.

σ or PTOL. and UL. BEIGH's 17th Eridani.

FLAMSTEED says, he could not see this star in 1691 and 1692. In 1782, 1783, and 1784, I observed one of the 7th magnitude in that place; the relative brightness of which appeared always the same, *viz.* less than two little stars near and below γ Eridani.

FLAMSTEED's 41 Tauri.

This star was thought by CASSINI to be a new one or variable. I see little or no reason to be of that opinion; that it is not new is evident, since it is UL. BEIGH's 26th and TYCHO's 43d. In 1784 and 1785 I found it of the 5th magnitude, being equal to ϕ , and brighter than ψ , P, and χ Tauri.

Star about $2^{\circ}\frac{1}{4}$ North of 53d Eridani, and 47 Eridani.

The first of these stars CASSINI thought a new one, and that it was not visible in 1664. In 1784 I found it was less than ω , and d , brighter than A, and seemed equal to ψ Eridani.

CASSINI mentions another star thereabouts, which he also esteemed a new one: this is probably FLAMSTEED's 47th. In 1784 it appeared rather less than 46th.

γ Canis Majoris.

MARALDI could not see this star in 1670; but in 1692 and 1693 it appeared of the fourth magnitude. I have very frequently noticed it since 1782, but perceived not the least variation, being constantly of the 4th magnitude, very little brighter than θ , and decidedly brighter than ι .

 $\alpha \beta$ Geminorum.

If either of these stars have changed in brightness, it is probably the β . In 1783, 1784, 1785, the β was undoubtedly brighter than α .

 ξ Leonis.

MONTANARI says, this star was hardly visible in 1693. I found it constantly in 1783, 1784, and 1785, of the same brightness, being of the 5th magnitude; less than A, π , and, if any difference, rather brighter than b and ω Leonis. TYCHO, FLAMSTEED, MAYER, BRADLEY, &c. mark it of the 4th magnitude.

 ψ Leonis.

This star is said to have disappeared before the year 1667. It is now, and has ever been since 1783, of the 5.6th magnitude, being less than ω , and brighter than i , FLAMSTEED's 46th.

25th Leonis.

In 1783 I first perceived this star was missing; nor was it visible in 1784 and 1785, even with the transit-instrument.

BAYER's ι Leonis, or TYCHO's 16 Leonis.

It was not visible in 1709, nor could I see it in 1785. This is a different star from the ι Leonis of the other Catalogues, though TYCHO's *description* of its place is the same.

 δ Ursæ Majoris.

This star is suspected to change in brightness (see LONG's Astronomy), on account of its being marked by TYCHO, Prince of HESSE, &c. of the 2d magnitude; while HEVELIUS, BRADLEY, and others, have it of the 3d. At present, and for these three years past, it appears as a bright 4th magnitude, being rather less than ι , equal to α , and rather brighter than κ Draconis.

 n Virginis.

This star is supposed to be variable, because FLAMSTEED, on the 27th of January, 1680, says he could not see it. He observed it May 12, 1677, and some years afterwards, since it is in his Catalogue. I examined it frequently in 1784 and 1785, without perceiving the least change, being of the 6th magnitude, less than c , and *rather* brighter than a star three degrees lower in a right line with c and n Virginis.

BAYER's star of 6th magnitude, 1° South of γ Virginis.

This star is not in any of the nine Catalogues that I have. MARALDI looked for it in vain; and in May, 1785, I could not see the least appearance of it. It certainly was not of the 8th magnitude.

In the northern thigh of Virgo.

This star, which is marked by RICCIOLUS of the 6th magnitude, could not be seen by MARALDI in 1709; nor was it of the 9th magnitude, if at all visible, in 1785.

91 or 92 Virginis.

In 1785 I found that one of these stars was missing, and which seems to be the 91; the remaining one is of the 6.7th magnitude.

α Draconis.

I am of Mr. HERSCHEL's opinion, that it is highly probable this star is variable. BRADLEY, FLAMSTEED, &c. mark it of the 2d magnitude; at present it is only of a bright 4th. I have frequently examined it since October, 1782, without perceiving the least change, being constantly rather less than α Draconis, equal to δ Ursæ Majoris, and rather brighter than α Draconis.

BAYER's star in the west scales of Libra.

MARALDI says he could not see this star; nor could I in 1784 and 1785. With a night-glass may be seen thereabouts
some

Some small stars of about the 8th magnitude, none of which are near as bright as the 2d ν Libræ.

PTOL. and UL. BEIGH's N° 6 of the unformed in Libra.

In examining different Catalogues I do not find this star in any other than the above, though it is marked of the 4th magnitude. If PTOLEMY had not the κ it might be thought to be that. In 1785 I frequently observed a star of the 7th magnitude very near its place, which appeared rather less than FLAMSTEED's 41. FLAMSTEED has not this little star in his Catalogue; but he observed it May 9, 1681.

κ Libræ.

This star is thought to be variable.—I am not of that opinion; though certainly it is rather singular that HEVELIUS, whose attention was directed to this part of the heavens, to find TYCHO's 11th, did not observe the κ ; and the more so, as he has noticed two much lesser stars not far from it. During these three years I have found the κ constantly of the 5th magnitude, being less than ψ or θ , equal to λ , and brighter than η .

TYCHO's 11th Libræ.

HEVELIUS says he could not find a star of the 4th magnitude in Libra noticed by TYCHO. This must be TYCHO's 11th, since he has all the others. It was not visible in 1783, 1784, and 1785, nor probably ever existed; for it is, I think, evident, that this 11th is no other than the κ , with an error of two degrees in longitude.

33 Serpentis.

In 1784 I perceived that this star was missing; nor was it visible in 1785 with a night-glass.

A star marked by BAYER near ϵ Ursæ Minoris.

CASSINI could not see this star. In 1782 I took, with a night-glass, a plan of all the stars near its place, and near the ϵ , none of which were brighter than the 7.8th magnitude. I have since re-examined the plan, but found no alteration.

The ρ or PROL. and UL. BEIGH's 14th. Ophiuchi or FLAMSTEED's 36th.

I have no doubt but that this is the star which is said to have disappeared before 1695. It is also evident, by what HEVELIUS says in his Catalogue on the θ and B, that the ρ was not seen by him. In 1784 and 1785 I found it of the 4.5th magnitude, much brighter than 39, also rather brighter than 51 and 58, and less than 44. On the 30th of June, 1783, I have marked it in my journal equal to 39, and less than 51 and 58; but as the observation was not repeated, I am far from being certain it has undergone any change, particularly as this star has a southern declination of 26° , and therefore great attention must be given to the state of the atmosphere.

PROL.

PTOL. 13th and 18th Ophiuchi, 4th magnitude.

If there is no error in the Catalogue, these two stars have disappeared; but I am confident that PTOLEMY's 13th is FLAMSTEED's 40th, and that PTOLEMY's 18th ought to be marked with a north latitude instead of south, which would make it agree nearly with FLAMSTEED's 58th.

σ Sagittarii.

Mr. HERSCHEL, with great reason, has placed this star among those which probably have changed their magnitudes. I had long since remarked the singular disagreement in all the Catalogues, which induced me to observe it frequently, particularly in 1783, 1784, and 1785, when it appeared of the 2.3d magnitude, and brighter than π Sagittarii.

θ Serpentis.

MONTANARI says he saw this star of the 5th magnitude, and that the next year it grew bigger. I examined it frequently in 1783, 1784, and 1785, and found it always less than δ Aquilæ, equal to β Aquilæ, and ρ Ophiuchi; 4th magnitude.

TYCHO's 27th Capricorni.

This star was not visible in HEVELIUS's time; nor could I see it 1778, 1782, 1784, with the transit-instrument.

TYCHO's 22d Andromedæ and σ Andromedæ.

CASSINI remarked, that the star placed by TYCHO at the end of the chain of Andromeda as of the 4th magnitude, was grown so small that it could scarcely be seen. This is TYCHO's N^o 22, the longitude and latitude of which places it near the two π Cygni, and where no star was visible in 1784 and 1785.

As possibly, by TYCHO's description, CASSINI took the 22d for the σ Andromedæ, I have also examined this star, and in 1783, 1784, and 1785, found its relative brightness thus: less than α Cephei; equal to ζ Cassiopeæ, though, if any difference, rather brighter; and brighter than λ , ν , or ι Andromedæ.

TYCHO's 19th Aquarii.

This is the star that HEVELIUS says was missing, and that FLAMSTEED could not see with his naked eye Nov. 18, 1679; nor could I see the least appearance of it in 1782. I am convinced it is the same star as FLAMSTEED's 56th, marked *f* by BAYER, from which it is only $1^{\circ}\frac{1}{2}$. FLAMSTEED's 53d, marked *f* in PTOLEMY's Catalogue, is a different star.

LA CAILLE's 483 Aquarii.

I first discovered that this star was missing in 1778. It was not visible in 1783, 1784.

There are a few other stars suspected by the ancient astronomers to have been new or altered a little in brightness, which I have omitted, not seeing any reason to think them so; and some that are certainly variable, but cannot be observed in these

these latitudes. I have also, contrary to my first intention, added several which are not mentioned by them; such are those that I lately discovered to be missing.

Perhaps many persons would place in the first class several stars which I have put in the second, relying on the positive assertions we have of their having disappeared, diminished, or being new; for my part, I am confident that most of these supposed changes may be attributed to mistakes; and in general for those that are said to be lost, an attentive comparison of different Maps and Catalogues will point out the error; and thus I have ventured to give my opinion of TYCHO's 20th Ceti, 11th Libræ, and 19th Aquarii, &c. Since FLAMSTEED's Catalogue has been more particularly investigated, the number of these supposed lost stars is considerably increased; but if the second volume of his *Hist. Cœlest.* is also examined, many errors will be detected; among which it will appear very unaccountable, that the 71st, 80th, and 81st of Hercules, which were discovered to be missing by Mr. HERSCHEL, are not in FLAMSTEED's observations under the name of Hercules, though I looked for them with particular attention, and find the 70th. The 19th Persei, which Mr. HERSCHEL also could not see, was observed but once by FLAMSTEED, *viz.* Jan. 16, 1693, and in all probability is the τ with the time of its transit erroneously set down. The τ was observed on Jan. 17, 1693, and Jan. 18, 1694. Besides these Mr. GOODRICKE has found several other errors still more evident. I scarcely need add, that these corrections do not in the least intimate any mistake or diminish the merit of those that first point them out, but fall entirely on the ancient catalogues and observations.

Mr. HERSCHEL, in selecting several stars which possibly may be reckoned new ones, very judiciously gives us plausible reasons

not:

not to lay great stress on their being so; and the following remark only confirms what he there suggests; for that star of the 5th magnitude following γ Persei, mentioned by him, and which with great reason might be esteemed a new one, is in all probability the same as one observed by FLAMSTEED, Jan. 18, 1694, though not inserted in his Catalogue.

With regard to those stars which are said to have diminished or increased, as those in Andromeda, Leo, &c. they are, in my opinion, far from being confirmed as variable. I know, from repeated experience, that even more than a single observation, if not particularised and compared with neighbouring stars, is very little to be depended on; different states of the weather, thin streaks of clouds, have several times made me err a whole magnitude in the brightness of a star.

Whether these apparent changes in the stars proceed intirely from themselves; or whether they are effected by any foreign power that may in part occasion some of their particular appearances and irregularities, we have not sufficient *data* to determine: but whatever are the causes, a division of the different phænomena seems to be the most probable means of forwarding any conjecture that hereafter may be formed; I shall therefore divide the first class into three orders.

The first contains those that are periodical with long intervals; and such I reckon α Ceti, that in Hydra, that in the Swan's breast and neck, and also MAYER's N° 420.

For the second order I shall mention only three, though others might be added; but the accounts of them are so unsatisfactorily recorded, and their places so little known, that I prefer selecting only that in Cassiopea of 1572, that in Serpentarius of 1604, and that near the Swan's head. The phænomena of these certainly bear a great resemblance to the first:

first: still their sudden appearance, and no certainty of a period, or at least infinitely longer, are, I think, sufficient reasons to separate them.

Lastly, Algol, η Antinoi, β Lyræ, and δ Cephei, are so similar to each other, and so different from the above, that there can be but little or no hesitation in distinguishing them; also the cause of their changes seem in general to be attributed to spots, and a rotation on their axis. This property of the fixed stars, though often suspected, was far from being evident till within these two years; and we are not only indebted to Mr. GOODRICKE for the discovery of the first, but also for three of the only four known.

Further may be added, that all those of the first order (MAYER's 420 being yet so little known remains doubtful) attain in different periods different degrees of brightness when at their full; also the progressive increase of brightness of that in Hydra, that in the Swan's breast, of α Ceti, β Lyræ, η Antinoi, and δ Cephei, is not similar to their decrease. This peculiarity with regard to Algol is yet uncertain, owing to the rapidness of its changes, so that there is only one that seems to have these points uniform, *viz* the variable in the Swan's neck.

I shall now conclude with the observations from which some results, given in this Paper, have been deduced; they are here collected together, in order to avoid confusion.

Observations on the variable in Hydra.

n * Variable	NORTH * γ	* * k	γ of 3d magn. ψ of 4th — k of 6.7th — π of 8th — n of 11th —
π	SOUTH	ψ	

1783, Dec. 11. A.M. much less than ψ , and rather less than k .

24. A.M. equal, if not less than, ψ ; of the same colour as ψ .

1784, Jan. 4. A.M. { brighter than ψ ; of about $\frac{1}{4}$ of the difference between
 ψ and γ ; of a more copper colour than ψ .

9. A.M. } if any difference brighter.

10. A.M. }

25. A.M. { with the naked eye, it appeared in brightness nearly between
 ψ and γ ; and of a more copper colour than either ψ or γ .

Feb. 1. } of the same brightness, but seemed of a more copper
2. } colour.

23. between ψ and k ; air not clear.

29. } between ψ and k , but nearer the brightness of ψ .

March 10. }

April 11. } rather brighter than k .

12. }

19. }

May 2. } rather less than k , and brighter than π .

9. rather less than k , and brighter than π .

1784, Dec. 1. A.M. did not see the variable; strong moon-light.

9. A.M. ditto ditto.

22. A.M. ditto ditto.

1785, Mar. 4. or 11. ditto ditto.

April 17. saw the π , but not the variable.

May 4. { visible to the naked eye; less than ψ , and much brighter
than k ; of a more copper colour than ψ .

7. } rather less than ψ .

11. }

- 1785, May 14. equal to ψ ; air not very clear, and moon-light.
 15. equal to ψ ; air clear; moon-light.
 19. undoubtedly brighter than ψ ; little hazy; moon near.
 22. } rather brighter than ψ ; moon-light strong.
 27. }
 June 10. rather brighter than ψ , though I think decreased.
 12. equal to ψ : but am not sure if the sky was quite clear.
 13. rather less bright than ψ ; air clear.

Mr. GOODRICKE also frequently observed the variable, and his observations agree with the above.


Observations on η Antinoi.

h.

- 1785, May 20. at $12\frac{1}{2}$ equal or less than ι Antinoi.
 21. — $12\frac{1}{2}$ equal to ι , evidently less than β ; moon-light.
 22. — $12\frac{1}{4}$ equal if not brighter than β Aquilæ; moon.
 — — $12\frac{2}{3}$ thought it brighter than β ; air clear.
 June 10. — $12\frac{1}{2}$ rather brighter than ι Antinoi.
 12. — $11\frac{3}{4}$ rather brighter than ι , less than β .
 13. — $12\frac{1}{2}$ a little brighter than β , much less than δ .
 July 15. — $12\frac{1}{2}$ less than β , brighter than ι .
 17. — 11 less than ι , brighter than μ .
 18. — 11 between ι and β , I think rather nearer β .
 19. — $\left. \begin{matrix} 10\frac{1}{2} \\ 11\frac{1}{2} \end{matrix} \right\}$ between β and δ , rather nearer β ; air clear.
 20. — 11 rather brighter than β , certainly equal.
 Aug. 30. — $9\frac{1}{2}$ rather brighter than β , at least equal to it.
 31. — 9 much brighter than β .
 Sept. 6. — 9 less than ι ; a single view of it, not very satisfactory.
 7. — $9\frac{1}{2}$ much brighter than β .
 26. — $\left. \begin{matrix} 9\frac{1}{4} \\ 10\frac{1}{2} \end{matrix} \right\}$ much less than β or ι , brighter than μ .
 27. — $\left. \begin{matrix} 8 \\ 10\frac{1}{2} \end{matrix} \right\}$ much less than β , less than ι , brighter than μ .
 28. — $9\frac{3}{4}$ rather brighter than β .
 — — 11 increased a little in brightness.

The brightness of the stars to which η Antinoi is compared are given in the Philosophical Transactions, vol. LXXV. part I.

Observations on the variable in Cygnus's Neck.

		\propto of 6th mag. d of 7th — e of 7th — a of 8th — b of 8th — c of 8.9 — b of 9th —	As KIRCH's plan (see Phil. Transf. abridged by JONES) is much the same as this, I have annexed the same letters to the stars.
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Dates.	Mag.	
1783		
Mar. 28	0	if visible, not of the 8th magnitude.
June 9	7	rather brighter than d or e .
11	7	rather increased.
23	6.7	less than \propto .
30	6.7	rather increased.
July 15	6.7	of the same brightness as on the 30th of June.
27	7	a little brighter than d or e .
Aug. 7	7	rather brighter than d ; decreased.
8	7	equal to d .
16	7	less than d , brighter than e .
25	7.8	less than e .
Sept. 4	7.8	think brighter than a .
12	8	equal to a .
22	8.9	much less than a , equal to c , and brighter than b .
24	9	equal to b .
Oct. 14	9.10	less than b .
24	10.11	{ seen with the greatest difficulty; less than any stars of the plan; am doubtful if I saw it by intervals.
27		
1784	0	{ I looked constantly for the variable between October and April, but could not see it.
April 23	10.11	less than any stars of the plan.
24	10.11	ditto.
May 9	9.10	rather less than b .

Dates.	Mag.	
<hr/>		
1784		
May 21	8 . 9	rather brighter than <i>b</i> , but not so bright as <i>b</i> .
June 17	8	equal to <i>a</i> , brighter than <i>b</i> .
July 21	6	equal to χ with the naked eye.
22	6	if any difference the χ was the brightest.
27	6	rather brighter than χ .
Aug. 1	5 . 6	undoubtedly brighter than χ .
10	6	think it decreased, but still rather brighter than χ .
13 }	6	rather less than χ .
19 }		
Sept. 2	6 . 7	much decreased, less than χ , but brighter than <i>d</i> .
12	6 . 7	still brighter than <i>d</i> .
19	7	if any difference brighter than <i>d</i> .
20	7	rather less than <i>d</i> .
Oct. 5	7 . 8	less than <i>e</i> , about equal to <i>a</i> .
16	7 . 8	rather brighter than <i>a</i> .
Nov. 11	9	less than <i>b</i> , about equal to <i>f</i> .
17	10	rather less than <i>f</i> .
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1785		
May 9	0	not visible.
June 21	9 . 10	less than <i>b</i> .
July 23	8	rather brighter than <i>a</i> .
Aug. 13 }	7	{ a little brighter than <i>d</i> and <i>e</i> , much less than χ ; am not sure I could see it with the naked eye.
15 }		
27 }	6 . 7	{ not so bright as χ , much brighter than <i>d</i> ; I could see it with the naked eye, but the χ more distinctly.
28 }		
30	6	not quite so bright as χ ; naked eye.
Sept. 2 }	6	ditto ditto.
7 }		
11 }	6 . 7	{ very difficult to see with the naked eye, decreased in brightness; air clear.
12 }		
26 }	7	{ though the air was remarkably clear, it was with the utmost difficulty I could sometimes see it with the naked eye.
27 }		

