1.

Darkness at Noon;

OR, THE

GREAT SOLAR ECLIPSE,

OF THE 16th OF JUNE, 1806,

DESCRIBED AND REPRESENTED

IN EVERY PARTICULAR.

CONTAINING, ALSO,

AN EXPLANATION OF ECLIPSES IN GENERAL,

AND THE

CAUSES ON WHICH THEY DEPEND.

WRITTEN IN A STYLE, FAMILIAR AND EASY, AND ADAPTED TO EVERY CAPACITY.

BY AN INHABITANT OF BOSTON.

'Tis silence all, and universal maze;
A wond'rous twilight overcasts the skies;
At noon a darkness does usurp the day;
And stars break forth and glitter through the gloom.

BOSTON:
PUBLISHED BY D. CARLISLE & A. NEWELL,
And for Sale at their respective Printing Offices.
MAY, 1806.

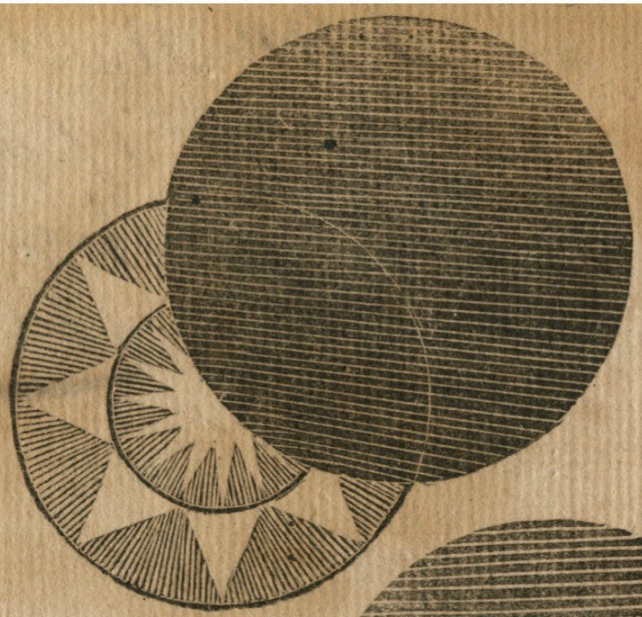
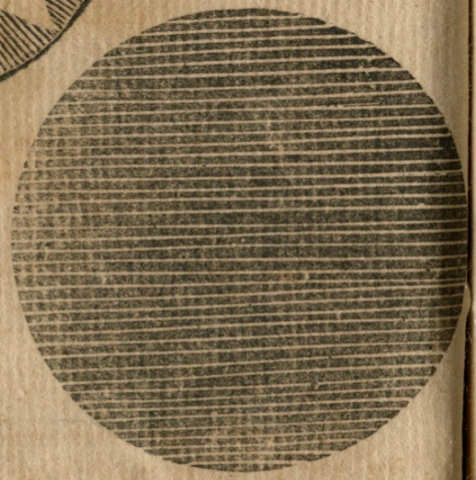


Fig. 1.

Fig. 2.



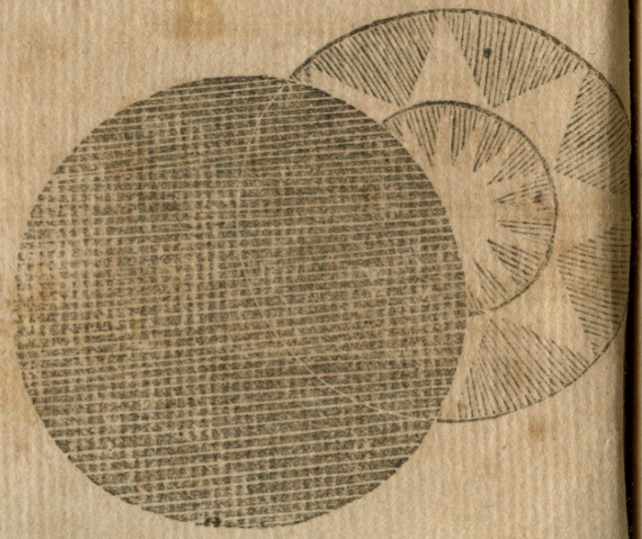


Fig. 3.

Darkness at Noon;

OR, THE

GREAT SOLAR ECLIPSE,

OF THE 16th OF JUNE, 1806,

DESCRIBED AND REPRESENTED

IN EVERY PARTICULAR.

CONTAINING, ALSO,

A GENERAL EXPLANATION OF ECLIPSES,

AND THE

CAUSES ON WHICH THEY DEPEND.

THIRD EDITION.

BY AN INHABITANT OF BOSTON.

'Tis ſilence all, and univerſal maze;
A wond'rous twilight overcaſts the ſkies;
At noon a darkneſs does uſurp the day;
And ſtars break forth and glitter through the gloom.

BOSTON:

PUBLISHED BY D. CARLISLE & A. NEWELL

And for Sale at their reſpective Printing Offices.

MAY, 1806.

PREFACE TO THE READER.

THIS publication originated from the following circumſtance : a few days ſince I was viſited by a gentleman of my acquaintance, who ſuggeſted the ſcheme of publiſhing a pamphlet which ſhould give a deſcription of the great Solar Eclipſe in every particular ; at the ſame time be accompanied with an explanation of eclipſes in general, and the cauſes on which they depend.

In conformity to his propoſition, I have commenced the taſk with ſome reluctance ; doubtful of my ability to do juſtice to the ſubject. I have had but little time to examine my manuſcript, which may occaſion ſome imperfections that otherwiſe might have been prevented. I have endeavoured to be plain and conciſe as poſſible, and muſt acknowledge there are ſome repetitions ; but the plan is ſuch

that I could not avoid them. In the deſcriptions, I have referred to ſome of the moſt familiar objects in common life, in order to enforce an idea which otherwiſe might have been too obſcure to be perfectly underſtood. There is nothing inſerted but what may eaſily be comprehended by any perſon, without the ingenuity of art, or the aid of ſcience. And it is preſumed that the experiments are ſuch, and the illuſtrations ſo plain, that they may be made without the leaſt inconvenience; and which carry the full force of the ſubject in every particular. The whole was haſtily put together, as it was ſuggeſted at a late hour. Under this diſadvantage the work is ſubmitted to the public.

THE AUTHOR.

Boſton, May, 1806.

INTRODUCTION.

THE Science of Aſtronomy, in all ages, has been a ſubject of admiration, and it juſtly claims the diſtinction of ſuperlative excellence. By its diſcoveries, knowledge has been diffuſed in rich variety over the face of the civilized world; and imagination has found a field where it can rove without reſtraint or limitation. Though it relates principally to objects whoſe diſtances are immeaſurable, and whoſe numbers are infinite; yet we are not to conclude that they have no relation with terreſtrial things; or that they are diſconnected with that ſyſtem of which we form a part.

The diſcoveries which have been made in this ſcience within the three laſt centuries have exceeded the warmeſt expectations of human reaſon; for the mind, which was once limited to the narrow confines of a little earth, is now able by the teleſcope to travel ſpace, and make excurſions into the diſtant regions of the heavens; and a proſpect is now opened to us, as wonderful as it is infinite. But its ſublimities are not its *only* recommendation: by it, ſcience has been improved, navigation promoted, and knowledge and invention carried to the utmoſt boundaries of human ingenuity. By its aid the mechanic arts have flouriſhed, and by their union, have yielded the richeſt harveſt of intellectual gratification.

The daily riſing and ſetting of the ſun and moon, with the milder glories of a nocturnal firmament, are ſome of the common ſpecimens of celeſtial magnificence. We admire, indeed with propriety, the ſublime indications of an " infinite creative mind;" and whilſt we are charmed with the uſual diſplays of his wiſdom and goodneſs, we are led to make a tranſition from " nature to nature's God." But theſe are ſcenes which, from their frequency, are regarded with indifference; they are too often repeated to impreſs the mind with a remembrance of their origin, or a recollection of their deſtiny in the perfection of the preſent ſyſtem.

But on ſome occaſions, nature aſſumes a ſurpriſing aſpect. The novelty of the event produces inquiry and univerſal aſtoniſhment. Either the reverberating echo of diſtant thunder, or the alarm of an approaching earthquake, awakens the mind from its indifference, and excites to reaſon, thought, and reflection. But *a total eclipſe of the ſun* is ſtill more remarkable, as ſuch an appearance has not happened at this metropolis ſince the ſettlement of New England; and probably many ages may paſs before the ſame phenomenon will be repeated.

From theſe circumſtances it may be neceſſary to enter into a minute deſcription of this eclipſe, and to relate every particular relative to this uncommon event; that whilſt the appearance itſelf is clearly explained, it may alſo prevent unreaſonable fear and fooliſh anxiety.

A DESCRIPTION OF THE ECLIPSE.

THIS remarkable eclipſe will happen on Monday, June 16th, in the forenoon: the times and appearances of which will be as follow:

	h.	*m.*	*s.*	
Beginning of the eclipſe,	9	58	45	*Forenoon.*
The moon's northeaſterly ſide will touch the ſun's centre, as in fig. 1.	10	39	00	*Forenoon.*
Middle of the eclipſe, or total diſappearance of the ſun behind the moon, as repreſented in fig. 2.	11	22	15	*Forenoon.*
The moon's edge will leave the ſun's centre, as in fig. 3.	12	5	00	*Afternoon.*
Ending of the eclipſe,	12	46	15	*Afternoon.*

The duration of this eclipſe will be 2 hours and 48 minutes, and the time of *total obſcurity* will be 3 minutes and 30 ſeconds, as ſeen from Boſton.

As the moon's *dark ſhadow* will make a circle on the earth's ſurface, ſome parts of this circle cannot be ſo broad as others. Conſequently, in ſome places, the duration of *total obſcurity* will be not more than a minute, and at others it will not exceed a ſecond. And to all thoſe places over which the centre of the ſhade will paſs, the ſun will be totally concealed for more than 3 minutes.

The beginning of this eclipſe will be on the ſun's ſouth weſterly edge, nearly; that is, 43 degrees from his vertex, or higheſt point, and on the right hand ſide. Therefore, an obſerver who wiſhes to ſee the *beginning* muſt direct his attention to that part of the ſun's edge.

Note.—The ſun's *higheſt* edge we call the weſt; the *loweſt* the eaſt; on the right hand the ſouth; and on the left hand the north ſide of his body; but in the afternoon it is reverſed.

DESCRIPTION OF THE FRONTISPIECE.

THE three figures in the frontiſpiece repreſent three different views of this eclipſe. Fig. 1 ſhews us how the ſun and moon will appear when the ſun is half obſcured, that is, when the moon's edge will ſeem to touch the ſun's centre; and the ſun, at that inſtant, will appear to hang on the north-eaſterly ſide of the moon, as repreſented in that figure.

Figure 2 repreſents the appearance of the moon in the middle of the eclipſe, at which moment the ſun will entirely diſappear behind her dark body. This will be the time of the greateſt darkneſs, and will occaſion a gloom and chill ſimilar to night. Probably the principal ſtars of the firmament will appear, eſpecially thoſe of the largeſt apparent magnitude, and will glitter as if in nocturnal ſplendor. This we have reaſon to believe, if we credit the records of antiquity. The ſolemnity and aſpect of the ſcene will be very ſingular, preſenting an appearance of which we can have no idea, and converting the day into a temporary night.

Fig. 3 repreſents the appearance when the moon is leaving the ſun's centre. The moon will quit the ſun in a ſouth eaſterly direction, as may be ſeen in figure 3. It is evident from the figures that the moon will then *appear* larger than the ſun, otherwiſe the ſun could not be totally eclipſed, as repreſented in figure 2.

It may be proper to mention that theſe calculations were made particularly for Boſton; and that the eclipſe will be total *only* at particular places. It will be ſeen at Albany very much as it will be at Boſton; but at Philadelphia the moon will appear to paſs north of the ſun's centre, and as ſeen from thence will not be total. On the contrary, at Weſt Portland, about 200 miles north-eaſt from Boſton, the moon will paſs ſouth of the ſun's centre, and as viewed from that place, the ſun's north ſide will be viſible in the middle of the eclipſe; and conſequently cannot there be total. But it would be an endleſs affair to repreſent this eclipſe as it will appear at all places, becauſe the diſtance of 50 miles will occaſion ſome difference. If we could tranſlate ourſelves to the earth's centre, and could view the eclipſe through the dark body of the earth, the ſun would appear only one third obſcured; and at London it will be leſs than a third.

At the time of this eclipſe, the moon's dark ſhadow will cover a circular ſpot on the earth's ſurface of about 104 miles in diameter; and Boſton will be in or near the centre of this dark circle at the time of the middle of the eclipſe. Conſequently, perſons remote from Boſton, 50 or 60 miles, north or ſouth, will ſee a part of the ſun; and to them the eclipſe cannot be total. But as the motion of the ſhadow is in an eaſterly direction, thoſe who live in that or a weſterly direction will be more likely to ſee the eclipſe total than thoſe differently ſituated.

During the eclipſe, the moon's motion from the ſun, through the heavens, will be at the rate of 39 miles every minute of time; and with the ſame velocity her ſhadow will travel over the earth's ſurface, which is almoſt five times as ſwift as the motion of a cannon ball. It is true we ſhall not be ſenſible

of this motion, becauſe we are not in a proper ſituation to obſerve it.

Although the moon's dark ſhadow will not much exceed 100 miles in breadth; yet her penumbra,* or faint ſhadow will cover an extent of almoſt five thouſand miles on the earth's ſurface, viz. from 11 degrees to 82 degrees north latitude, within which the ſun will appear more or leſs obſcured, as the obſerver is leſs or more diſtant from the centre of the ſhadow. Beyond the above limits the whole body of the ſun will appear. This eclipſe will probably be ſeen total in ſome parts of Africa and in the Atlantic ocean.

* The moon's penumbra is a fainter ſhadow ſurrounding the dark one. When the penumbra touches any place on the earth's ſurface, the eclipſe begins at that place; and when the penumbra leaves it, the eclipſe ends. Within the centre of this penumbra lies the dark ſhadow, whoſe breadth is greater or leſs, according as the moon's apparent diameter exceeds the ſun's. Within the dark ſhadow the ſun is inviſible; but between the edge of the penumbra and the edge of the dark ſhadow, a part of the ſun is ſeen; and the degree of obſcuration is *greater* or *leſs* according as the obſerver is at a *leſs* or *greater* diſtance from the center of the ſhade. Beyond the edge of the penumbra the whole body of the ſun is ſeen without any interruption.

When the ſun appears larger than the moon, at the time of any eclipſe, there is no dark ſhadow at that time; and to all thoſe places over which the centre of the penumbra then paſſes, the ſun will be centrally eclipſed like a ring, appearing like a circle made of braſs wire. Of this deſcription was the remarkable eclipſe which happened April 3, 1791, on Sunday morning.

To repreſent, by a figure, the moon's penumbra, with the dark ſhadow in the centre, chalk a large circle on the floor, about 3 feet in diameter, which ſhall repreſent the penumbra; in the centre make another circle of about two inches in diameter; this laſt ſhall repreſent the dark ſhadow. This dark ſhadow can only happen at the time of a total eclipſe of the ſun.

Conceive the large circle, which we have juſt made, to travel over the earth's ſurface; when its edge touches any place the eclipſe then begins at that place; and when its oppoſite edge leaves that place, the eclipſe ends. Theſe circumſtances conſtitute the *beginning* and *ending* of an eclipſe of the ſun.

A DESCRIPTION OF THE FIRMAMENT

At the time of total obſcurity, and of the ſtars which will then moſt probably be viſible.

AFTER the ſun diſappears behind the moon, the latter will appear like a black patch in the ſky, and this is exactly repreſented in figure 2. There will probably be a twilight ſurrounding the moon on all ſides, and the darkneſs will be conſiderable, perhaps almoſt equal to night. By inſpecting a celeſtial globe, I find the following ſtars will moſt probably appear. The remarkable conſtellation of *Orion* will be ſeen on the ſouth ſide of the moon, about the diſtance of 24 degrees. The *Dog Star* will be ſituated in a ſouth eaſterly direction, from *Orion*, and is one of the largeſt in the firmament, and paſſes the meridian at midnight, in the month of January. It may be diſtinguiſhed by its brilliancy and ſparkling luſtre. [This is the ſtar, which, ſome people think, occaſions the exceſſive heat of the ſummer months, as it then riſes and ſets with the ſun. But this is a fooliſh notion.] A little weſtward of the moon may be ſeen that fine bright ſtar, called *Bull's Eye*, ſituated in the conſtellation of the *Bull*. This alſo is a very large brilliant ſtar. There is another large ſtar called *Hydra's Heart*, ſituated in the conſtellation of the *Hydra*. It will appear in a ſouth eaſterly direction, and will be very near the horizon. If the darkneſs is ſufficiently great, the *Pleaides*, called the *Seven Stars*, will be ſeen on the weſterly ſide of the moon; but as they appear very ſmall, they may not then be viſible.

Several of the planetary bodies will be viſible.—The planets *Mercury*, *Venus*, and *Mars*, will be ſeen

in a weſterly direction from the moon. The other planets will then be in the lower hemiſphere, and conſequently cannot be viſible to us, till after ſun ſet.

This eclipſe is ſuch a novelty in the phenomena of nature, that a ſimilar may not again take place for many ſucceeding ages.

This eclipſe can be ſeen with moſt advantage by a good teleſcope; but as few perſons are poſſeſſed of this inſtrument, perhaps the beſt ſubſtitute is one of the dark glaſſes of a common quadrant. By this means the ſun can be viewed without any offence to the eye. As the ſun at that time of the day will be very high in the heavens, it may be a convenience to view his image by a common looking glaſs, by which means he may be ſeen in any direction; and to look directly into the glaſs inſtead of the ſun. In this caſe the darkened glaſs muſt be uſed as in the firſt inſtance. The management of this apparatus will not be difficult. Thoſe who are poſſeſſed of a ſeaman's quadrant will find it extremely convenient in viewing the ſun. By this inſtrument, the ſun's image can be ſeen in any poſition, as ſhall pleaſe the obſerver.

A common ſpy glaſs may be made to anſwer extremely well inſtead of a teleſcope. The front glaſs muſt be cloſed by ſomething to intercept the greateſt part of the ſun's rays, to take off the glare of light. Perhaps a piece of very thick green glaſs will do very well. But every one muſt try that which beſt anſwers his purpoſe.

Thoſe who are not poſſeſſed of any of the contrivances above mentioned, muſt have recourſe to a piece of common window glaſs, ſmoaked on both ſides ſufficiently to prevent any injury to the eye. The glaſs ſhould be ſeveral inches ſquare to be uſed with good advantage, and it will be much more convenient than a ſmall piece. The ſmoak of a common lamp is probably the beſt for this purpoſe, as the glaſs will not be ſo liable to crack.

CONCERNING THE CAUSES OF ECLIPSES,

And the manner in which they are produced.

IN the leſs enlightened ages of the world, the eclipſes of the ſun and moon were regarded with ſurprize and conſternation, and as intimations of divine diſpleaſure. Amongſt many of the ancients, they were conſidered as the harbingers of diſaſtrous events, and as indications of ſome revolution in the phyſical ſyſtem of things. But thanks to the progreſſion of ſcience, that whilſt we are exempted from the ſlavery of ſuperſtition, we are enabled to predict them with certainty, point out the cauſes of their aſpects, and the period of their return.

Eclipſes are cauſed by the Earth, the Sun, and the Moon. The Sun can be eclipſed *only* at the *Change*, and the Moon can be eclipſed *only* at the *Full*. But the Sun is not eclipſed at *every* Change, nor the Moon at *every* Full, although ſhe changes and fulls every month in the year. The reaſon of this we ſhall ſoon explain.

Every body that is expoſed to the ſun is enlightened by that luminary, and caſts a ſhadow behind it, towards that part of ſpace which is oppoſite the ſun. The truth of this obſervation may be realized on numerous occaſions. At the riſing of the ſun, the ſhadows of all bodies are directed towards the weſt,

and at his ſetting, they are projected in a contrary direction. It is exactly ſo in the heavens : the earth throws a ſhadow behind it, ſo alſo does the moon. The obſervation is equally applicable to the planetary bodies ; but they are too remote ever to eclipſe the ſun, or to be eclipſed by the earth's ſhadow.

If the Earth was a body as *large* as the Sun, the ſhadow of the former would be in the form of a cylinder, that is, of equal dimenſions in every part. If the earth was *larger* than the ſun, its ſhadow would increaſe in ſize, and ſpread, and would cover almoſt half of the viſible heavens. But as neither of theſe is the figure of the earth's ſhadow, we may juſtly conclude that the ſun is the largeſt, and that the ſhadow, at a certain diſtance, converges to a point. Now, as this is demonſtrably certain, it is evident that the ſun is vaſtly larger than the earth ; ſince it is well known, that if the earth could be viewed from the ſun, it would dwindle into the humble aſpect of a ſolitary ſtar, and ſometimes would be quite inviſible. The point where the earth's ſhadow terminates, is found by calculation to be about three times the diſtance of the moon ; but its diſtance is continually altering, according as the earth approaches or recedes from the ſun. Theſe truths afford us ſome idea of the immenſity of creation ; and objects which we denominate large, are nothing when placed in compariſon to a univerſe whoſe extent is commenſurate with infinity.

As we have proved from the above reaſoning, that the earth is a much ſmaller body than the ſun, it is eaſy alſo, from the ſame arguments, to prove that the moon is leſs than the ſun. It alſo can be proved that the moon is much ſmaller than the earth.

The moon's diameter is found to be 2170 miles ; and if the ſun was not larger than the moon, the dark

ſhadow of the latter would be 2170 miles, in diameter, that is, as large as the moon herſelf, which is contrary to facts ; for in any total eclipſe of the ſun, the moon's dark ſhadow never covers a ſpot on the earth's ſurface more than 200 miles, and generally much leſs ; and in moſt caſes there is no dark ſhadow, the moon's penumbra* being the only ſhade which obſcures the ſun. Therefore, "the moon's ſmall diſtance from the earth, and the ſhortneſs of her ſhadow, prove that ſhe is much leſs than the ſun."

In order to familiarize the preceding illuſtrations, we will have recourſe to a very ſimple experiment. Let us provide ourſelves with a common wooden ball, of about two inches in diameter. If we ſuſpend this ball from a ſtring, and expoſe it to the light of the ſun, we ſhall find that it throws a ſhadow behind it, and that this ſhade is leſſened at a greater diſtance from the ball. Now this could not be the caſe, if the ball was larger than the ſun ; if it was, its ſhadow muſt increaſe in ſize, and ſpread over a greater ſpace. To realize the truth of this obſervation, let the experiment be repeated with a candle in a large room. Here we ſhall find, that as the ball approaches the candle, its ſhadow will increaſe its dimenſions, and at a ſmall diſtance, will cover almoſt one ſide of the room : this is perfectly plain.

As we find, from uniform experience, that the earth's ſhadow is round, we may juſtly infer that the earth itſelf is globular ; otherwiſe its ſhadow could not be of that figure. It is true we cannot ſee the curvature of this ſhadow, but at the time of a lunar eclipſe ; and on ſuch occaſions its circular form may eaſily be diſtinguiſhed on the face of the moon.

Before we proceed any farther into the cauſes of

* The moon's penumbra is explained in a note, page 10.

eclipſes, it may be proper to explain ſome particulars relative to the ſun and moon, that we may the more readily comprehend how the ſun is *ſometimes* eclipſed by the moon, at the *Change*, and at the *Full* the moon is *ſometimes* eclipſed by the earth's ſhadow.

To make this matter plain, it will be proper to follow the moon in her monthly progreſs round the earth, that we may ſee the natural cauſes which muſt concur to produce eclipſes of the ſun and moon.

Whilſt the ſun appears to make a revolution round the earth once a year,* the moon deſcribes a revolution every month. The conſequence of theſe motions muſt be, that the moon will *paſs by* the ſun every month. This we call the *change* of the moon, and at that time ſhe is inviſible, becauſe her dark ſide is turned towards the earth. As ſhe paſſes from the *change*, ſhe removes to the eaſtward of the ſun, and ſets in the evening after that luminary, and appears in the weſt, in the form of a bow, with a ſmall edge of light. As ſhe progreſſes in her celeſtial courſe, ſhe increaſes her diſtance from the ſun, till ſhe arrives at her *firſt quarter*, at which time ſhe paſſes the meridian about ſix in the evening, and appears in the form of a half circle. From the *firſt quarter*, ſhe increaſes her face, till ſhe arrives at the *full*. She is then *nearly* oppoſite the ſun, appears like a full orb, and riſes in the eaſt whilſt the ſun is ſetting in the weſt. From the *full*, ſhe decreaſes, until her *laſt*

* There is another apparent motion in the ſun, which is his diurnal revolution, from eaſt to weſt, in the ſpace of 24 hours. A little obſervation will convince us, that this revolution is not confined to the ſun, but is common to the whole firmament. It is ſcarcely neceſſary to remark that these motions ariſe entirely from the earth's velocity round its own axis; and that this revolution occaſions the continual ſucceſſion of day and night. It is from this cauſe that the ſun and moon, and all the heavenly bodies, riſe and ſet every twenty four hours.

quarter; ſhe then riſes about midnight, appears half enlightened as before, and paſſes the meridian about ſix in the morning. From the *laſt quarter*, ſhe continues to decreaſe, until ſhe arrives at the ſubſequent *change*; ſhe then riſes and ſets with the ſun, and becomes inviſible.

As we have followed the moon throughout her monthly courſe, we plainly ſee that during *one* revolution ſhe muſt paſs near the ſun at the *change*; and near the earth's ſhadow at the *full*; and that her various aſpects of increaſe and decreaſe, ariſe entirely from her poſition with reſpect to the ſun and the earth; and we from hence infer, that the light of the moon is not her own, but the light of the ſun reflected by her dark body.

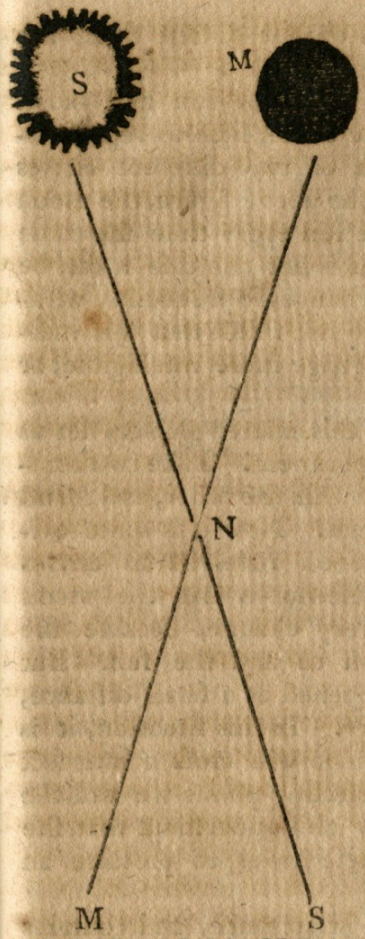
Although the moon, as ſeen from the earth, aſſumes different degrees of brilliancy and figure, yet we are to remember that one half is always enlightened by the ſun; but it is directed towards us, only at the full; ſhe then ſhows her whole enlightened face to our view.

After the preceding explanation, the queſtion will ariſe, Why have we not eclipſes of the ſun and moon every month, ſince the moon muſt paſs *near* the ſun at every *change*, and at every *full* ſhe muſt paſs *near* the earth's ſhadow? In reply to this queſtion, it may be proper to obſerve, that all this would happen, if the two luminaries revolved *exactly* in the ſame part of the heavens, in one common circle. In this caſe, the moon would paſs directly over the ſun at every *change*; and at every *full* ſhe would paſs through the centre of the earth's ſhadow, and be totally eclipſed for almoſt two hours. Conſequently, under theſe circumſtances, there would be two eclipſes every month in the year; one of the ſun, and one of the moon; and ſometimes three.

Now as the earth is continually revolving round the ſun,* and as this revolution is completed in the ſpace of twelve months, the ſun at the ſame time ſeems to make a circuit round the earth once a year; ſince, as it regards this particular, appearances are the ſame, whether it is the ſun or the earth that moves. This circle, which the ſun *appears* to deſcribe in the heavens, is called the Ecliptic, or the ſun's apparent annual path in the heavens. Now whilſt the ſun appears to move in this circle continually from Weſt to Eaſt, by his annual motion, the moon, at the ſame time, performs her revolution in the ſpace of 27 days, 7 hours, and 43 minutes, as determined by repeated obſervations.† From this explanation, it is eaſy to perceive, that if the ſun and moon moved *exactly* in one common circle, as ſeen from the earth, that in every revolution ſhe would paſs directly over the ſun, and conſequently produce an eclipſe. But that if the moon moves in a path which is not *exactly* in a line with the ſun's, ſhe may frequently paſs the ſun at the *change* without intercepting any part of his body. What we have only ſuppoſed, really takes place in nature. For the moon's path croſſes the ſun's in an oblique direction, like two lines interſecting each other. Perhaps this may be illuſtrated by a figure.

* If the earth's diſtance from the ſun is 95 millions of miles, and it completes its revolution in twelve months, it is certain that it muſt move 67 thouſand miles every hour.

† Whilſt the moon is making a revolution round the earth from weſt to eaſt, the ſun apparently is moving the ſame way. From this cauſe the moon muſt make ſomething more than one complete revolution to get round to the next *change*. The time which uſually intervenes between any two new moons, is 29 days, 12 hours, and 44 minutes.



The two lines S. S. and M. M. repreſent two circles viewed edgeways; and ſuch is the appearance of any circle when ſeen in that poſition. The line S. S. repreſents the path which the ſun appears to deſcribe in twelve months. The line M. M. repreſents the moon's path round the earth, which ſhe performs in one month. It is evident that theſe two circles croſs each other in one point at N. and this point is called the moon's *Nodes*. Now as the ſun always keeps in the circle S. S. and the moon in the circle M. M. it is eaſy to ſee, that when the moon *changes* near the ſun's path, ſhe muſt eclipſe him to ſome part of the earth; and this effect cannot be produced without the *Change* happens near the *Node* N. and this *Node* is *then* nearly in a direct line between us and the ſun. But when the moon *changes* at ſome conſiderable diſtance from the point N. ſhe cannot appear to touch any part of the ſun, that is, cannot produce an eclipſe, becauſe, in ſuch caſes, ſhe will paſs either to the northward or ſouthward of the ſun. This circumſtance is repreſented in the

above figure, where ſhe is too far diſtant from the ſun, to intercept any part of his body.

Now it is very plain, that if the ſun and moon moved in one and the ſame circle, ſuch as repreſented in the line S. S. inſtead of two different circles croſſing each other, as in the above figure, the moon would paſs *directly* over the ſun every time ſhe came to the *Change*. But as this is not the caſe, it can be no wonder that the moon changes ſo frequently without eclipſing the ſun. I do not think that this matter can be explained in language more intelligible, or illuſtrations more familiar.

If it be poſſible to make this matter plainer, let us make the following eaſy experiment. Take two common hoops, and place one within the other, and thruſt a wire directly through them. Now it is quite evident, that if the ſun and moon revolved in circles ſituated to each other as theſe hoops are, the moon would eclipſe the ſun at every change, becauſe ſhe would paſs directly between us and the ſun. But ſuppoſe the hoops to be opened at a ſmall diſtance, ſo as to incline to each other. In this ſituation, it is eaſy to conceive, that one hoop will croſs or interſect the other; and theſe interſecting points we call the moon's nodes: and we may alſo underſtand that ſhe muſt change near one of theſe nodes, to produce an eclipſe.

As this article is of ſome importance, and contains the ſubſtance of the whole ſubject, it may be uſeful to have recourſe to farther illuſtration from experiment, that the mind may have a perfect comprehenſion of the idea which we wiſh to enforce; and it is hoped, that the repetition ſo far from being burdenſome, will rather pleaſe; and inſtead of introducing obſcurity, will give the reader a full diſplay of this important ſubject.

Let a perſon place himſelf in the centre of a very large room, and near the oppoſite wall, to fix a candle exactly of the ſame height with his eye. In this ſituation, let a ſecond perſon take the ſuſpended ball, mentioned in a prior experiment, and, at the diſtance of 5 or 6 feet, move it round the head of the other, exactly of the ſame height with his eye, and the candle. The obvious reſult of this experiment is, that in every revolution of the wooden ball it will conceal the candle to the central obſerver, and to him the candle will be eclipſed. Let the ball be moved exactly half round. It is then oppoſite the candle, and muſt paſs through the ſhadow made by the obſerver's head, and muſt be totally eclipſed. After this let the experiment be repeated in ſuch a manner, that the moving ball in every revolution may riſe and fall gradually. In this caſe it may paſs the candle without intercepting it; and may paſs near the ſhadow without touching it. Here the candle may repreſent the ſun, the ball the moon, and the perſon ſtanding in the centre, an obſerver on the earth's ſurface. From hence we may infer, that it is the oblique direction in which the moon moves that prevents her from eclipſing the ſun at every change, or paſſing through the earth's ſhadow at every full.

If the ſun and moon were equally diſtant from the earth, an eclipſe of the ſun would have the ſame appearance to all parts of the earth. But the ſun is ſo remote, when compared with the moon's diſtance, that there is a great variety in the ſame eclipſe, as ſeen from different places. And notwithſtanding the moon is ſo very ſmall, when compared with the bulk of the ſun, yet ſhe is ſo much nearer, that ſhe uſually appears as large as the ſun, and ſometimes larger. To familiarize this idea, let us place ourſelves on Beacon Hill, and take a view of Boſton light houſe. In this

ſituation let us take a dollar and place it before our eyes at arm's length. This dollar, though ſmall, appears ſufficiently large to conceal the light houſe, and render it inviſible. This matter is ſo plain, that it requires no farther explanation, than to obſerve, that the diſtance of objects has great effect in increaſing or diminiſhing their apparent magnitudes ; and that a ſmall object, which is quite near, may appear large enough to obſcure another of a thouſand times its magnitude, at a remote diſtance. Now whilſt the perſon who has the dollar in his hand, is deprived of his view by the intervention of that dollar, a man ſtanding at the right or left has an uninterrupted view of the light houſe, and to him that object is not eclipſed. Theſe obſervations are equally applicable to bodies in the heavens ; only with this difference, that the experiment is there exhibited on a larger ſcale.

That theſe facts may be perfectly underſtood and realized, it may be uſeful to make another experiment, which will exemplify the matter to a demonſtration. Let us provide ourſelves with two circular cards, about 4 inches in diameter, cut from a piece of common paſte board ; one of which muſt be blackened to repreſent the moon at the *Change*, the other to repreſent the ſun, which may be ornamented with red paint, to make the reſult more ſenſible. Place the one which repreſents the moon, over the other that repreſents the ſun, in the manner repreſented in fig. 1 of the frontiſpiece, and pin them both againſt the wall, in a large room, of the ſame height with the eye, the moon being outſide. Now theſe cards will have exactly the ſame appearance when viewed from one part of the room as the other, which is a direct proof, that if the ſun and moon were of equal magnitudes, and were equally diſtant

from the earth, an eclipſe of the ſun would appear the ſame as viewed from different places.

Hoping that repetition will not become tedious, we will vary this experiment in the following manner : take the one which repreſents the ſun, and fix it againſt the wall as before, and place the other which repreſents the moon about 8 feet diſtant. From this variation we ſhall plainly ſee, that the two cards will *not* appear the ſame as viewed from all parts of the room ; and that in ſome ſituations they will appear exactly central ; but if we remove to the right or left, part of the ſun will be viſible, and in ſome poſitions will be ſeen without any interruption. This experiment, though trifling and ſimple, is an exact repreſentation of what takes place in the heavens; and is a direct proof of what was advanced in the beginning of the preceding paragraph. There are a variety of methods by which theſe things may be rendered plain and conſpicuous, without the aſſiſtance of philoſophy or the aid of mathematicks.*

Theſe facts ſerve to explain, why, at the approaching great eclipſe, the ſun will be totally concealed at Boſton, and at the very ſame inſtant, a part or the whole of his body will appear at many other places.

* Although the ſun and moon, are globular bodies, yet as ſeen from the earth, they appear like circular plates, and ſuch would be the appearance of the earth if viewed from the moon ; becauſe, when objects are very remote, the convexity of their ſurfaces is inſenſible to the eye. If the moon was in reality a circular plane as ſhe appears to be, ſhe would be inviſible from the *change* to the *firſt quarter*, and from the *laſt quarter* to the *change*.

When the moon is viewed by a good teleſcope, the convexity of her ſurface is very diſcernible; and on thoſe occaſions the central parts are plainly the moſt prominent, becauſe, by this inſtrument, the object appears as much nearer as it is magnified by the teleſcope ; for the magnifying power in a meaſure corrects the miſrepreſentation of the ſenſes, and makes the object appear of its true figure.

But if the ſun and moon were equally diſtant, their relative poſition would be exactly the ſame, whether viewed from London, or the Cape of Good Hope, and an eclipſe would appear the ſame in both places. But as the ſun's diſtance exceeds the moon's almoſt 400 times, we cannot wonder that in ſhifting our places on the earth's ſurface, the moon may conceal or paſs the ſun, according to our poſition with reſpect to the two bodies.

In eſtimating diſtances upon the earth's ſurface, we judge from ſome rule of compariſon, or by referring the diſtance to ſome known meaſure. By theſe means, we may, in ſome caſes, determine with a degree of accuracy, the diſtances of particular objects. But beyond certain limits our judgment fails us, and all rules of compariſon are uſeleſs. This is evident by our referring every body in the firmament at an equal diſtance; although it is well known that ſome celeſtial bodies are millions of miles beyond others. And if we could tranſlate ourſelves to that part of ſpace which ſeems to be the limits of creation, we ſhould ſtill find beyond us, "a boundleſs ocean, of which we could have no idea:" and ſuns and worlds would riſe in ſucceſſion in endleſs profuſion.*

* Since the diſcovery of the teleſcope, aſtronomy has attained a greater degree of perfection than was ever expected before the invention of that inſtrument. It is from this diſcovery that aſtronomical knowledge has been ſo ſurprizingly increaſed, and has laid open a field as wonderful as it is infinite. The lateſt improvement in this inſtrument is that of Dr. Herſchel. By his inquiries he has furniſhed us with a more correct deſcription of the univerſe, ſince, by his teleſcope, he was acceſſary to regions vaſtly beyond the limits of former obſervations. The proſpect which was opened to him affords us ſome idea of the extent of ſpace and the immenſity of creation. The milky way, which appears to the naked eye as a confuſed maſs of ſcattered light, is plainly repreſented by the teleſcope, as ſo many ſtars, whoſe combined luſtre creates the appearance which it uſually aſſumes; their diſtances being ſo

Before we diſmiſs this ſubject it may be proper to introduce one or two obſervations which have a cloſe relation to our preſent diſcuſſions. As the moon revolves round the earth every month, ſhe is once at her *greateſt* diſtance; this we call the moon's *apogee*; and alſo at her *leaſt* diſtance; this is called her *perigee*. In the firſt caſe ſhe appears *ſmalleſt*, becauſe ſhe is then moſt remote from the earth's centre: in the latter caſe ſhe appears *largeſt*, becauſe ſhe is then neareſt the earth: all which is very natural. The ſame obſervations are applicable to the ſun. As the earth performs its revolution round that luminary, in the ſpace of twelve months, it is once at its *greateſt* diſtance, and once at its *leaſt*. The two oppoſite ſeaſons of the year, when the ſun appears in theſe points are January and July. In the firſt caſe the earth makes its neareſt approach to the ſun. This is evident by the ſun appearing ſo much larger than uſual; and in the month of July he is moſt remote; for at that ſeaſon he appears ſmaller than at any other month in the year. Theſe facts may be contrary to the common notions of mankind, ſince we have cold weather in January and warm in July. But this difference ariſes from the obliquity of the ſun's rays in one caſe, and their perpendicularity in the other. In the winter, the ſun is low, and continues but a little time above the horizon; and his rays are more diſſipated, and cannot act ſo forcibly. But in the ſummer months the ſun riſes high, and continues longer above the horizon, and his rays fall nearly perpendicular upon the earth's ſurface. It is from the concurrence of theſe

amazingly great, that the unaſſiſted eye cannot diſtinguiſh one from the other. There are many parts of the heavens which ſeem like a blank ſpace to the naked ſight; but when viewed with a teleſcope appear crowded with bodies as brilliant as they are glorious.

two circumſtances that July is warmer than December, and occaſions the exceſſive heat which prevails at that ſeaſon.*

As we have progreſſed thus far in this ſubject, it may be proper to diſmiſs it for the preſent, and proceed to an explanation of *Lunar Eclipſes*, which being much more ſimple may be underſtood with leſs trouble.

From what has been illuſtrated in the preceding pages, it is plain, that an eclipſe of the moon can happen *only* at the time ſhe fulls; and the reaſon why ſhe is not eclipſed at *every full* remains now to be explained.

Although eclipſes of the ſun and moon are expreſſed by the ſame word; yet there is an eſſential difference, ſince an eclipſe of the ſun is nothing more than an interception of his light by the dark body of the moon; but that an eclipſe of the moon is a matter of reality, as ſhe is really deprived of her light by paſſing through the earth's dark ſhadow.

Although the moon fulls or is *nearly* oppoſite the ſun every month in the year; and muſt, at the time of her oppoſition, paſs in the neighborhood of the earth's ſhadow; yet in conſequence of the obliquity of her orbit, ſhe may full ſo far to the northward or

* It may be proper to obſerve, that in addition to the cauſes above mentioned, there is another circumſtance which greatly contributes to the heat of ſummer: the earth at this ſeaſon imbibes a greater proportion of the ſun's rays; in conſequence of which, it becomes amazingly heated, and the air, contiguous to the ſurface, is greatly increaſed in temperature accordingly.

It is a curious fact which is known to exiſt in all warm climates, in the hotteſt weather when the air, at the earth's ſurface, is extremely uncomfortable, that at the height of two or three miles, the cold is ſufficient to conſolidate water into ice. The appearance of clouds is a proof that the upper regions of the air are much colder than near the earth's ſurface; and this difference is the greateſt in the ſummer months.

ſouthward of the ſhadow, that ſhe cannot be eclipſed. It was before explained, that if the two luminaries were confined to one and the ſame circle, as ſeen from the earth, the ſun would inevitably be eclipſed every time that the moon paſſed the *change*, becauſe in ſuch caſes, ſhe would be interpoſed between us and the ſun. This repreſentation applies equally to eclipſes of the moon, ſince if they were both confined to one path in the heavens, ſhe would always at the full, paſs through the centre of the earth's ſhadow, and be totally eclipſed for almoſt two hours. But as the paths of the two luminaries ſeparate obliquely, like two hoops croſſing each other; it is plain, that a full moon may happen at ſuch a diſtance from the ſhadow, that there can be no eclipſe. But that when ſhe approaches the ſhadow ſufficiently near to paſs through any part of it, ſhe muſt inevitably be eclipſed more or leſs, according to her diſtance from the centre of the ſhadow. In ſome caſes only part of her body will enter the ſhadow, and ſhe appears eclipſed on one ſide. This we call a partial eclipſe of the moon; but if ſhe paſſes her whole body within the ſhadow ſhe will be totally eclipſed; and the duration of total darkneſs will depend upon the depth of ſhadow through which ſhe has to paſs.

Therefore, in calculating an eclipſe of the moon, we muſt find the dimenſions of that part of the ſhadow which ſhe paſſes through at the time ſhe fulls, together with her velocity acroſs the ſhadow. Theſe are the eſſentials in calculating an eclipſe of the moon. But the proceſs of the calculation cannot be introduced in a tract of ſuch confined limits as the preſent.

The earth's ſhadow is always directly oppoſite the ſun. Conſequently, if the moon did always full *exactly* oppoſite the ſun, ſhe would be eclipſed in every

month. But the moon *generally* fulls a little without the earth's ſhadow, and paſſes to the northward or ſouthward of it; in which caſe ſhe muſt full without being eclipſed.

To explain this matter a little farther by experiment, let us take a ball of two inches in diameter, and ſuſpend it by a ſtring, from the ceiling, between the wall and a candle, both being equally high from the floor; the ball at the diſtance of 3 feet, and the candle at the diſtance of 9 or 10 feet, from the wall. Under theſe circumſtances the ball will throw its ſhadow on the wall, and any body placed within that ſhadow, will be eclipſed from the light of the candle.

Whilſt the ball and candle retain their poſition, let us ſuſpend a marble from a piece of thread, and move it round the wooden ball, exactly of the ſame height as the candle. The marble muſt complete a revolution round the wooden ball, and be kept of the ſame height throughout its circuit. When it comes to be in oppoſition to the candle, it muſt paſs through the centre of the ſhadow made by the wooden ball, and be totally eclipſed. As it is moved farther on, it will quit the ſhadow, and the eclipſe will end. Now repeat the experiment in ſuch a manner, that the marble, in paſſing its *full* or *oppoſition*, may riſe above, or fall below the ſhadow, without touching it: in ſuch caſe, it will full without being eclipſed. Here the candle may repreſent the ſun, the wooden ball the earth, with its ſhadow, and the moving marble the moon, making her monthly revolution round the earth; and its paſſing through the ſhadow may repreſent a total eclipſe of the moon.

From this experiment it is evident, that if the ſun and moon moved in one circle, as ſeen from the earth, that is, both on the ſame level, that the moon would inevitably be eclipſed at every *full*; becauſe, on theſe

occaſions, ſhe would paſs through the earth's ſhadow. But as this is not the caſe, it is only in particular circumſtances that her eclipſes can happen.

The appearance of the moon in a total eclipſe has been likened to tarniſhed copper. This, by different perſons has been differently explained; and by them referred to various cauſes. A probable cauſe is the ſcattered light of the heavens, which is diſſipated in every direction, from the numberleſs ſtars which compoſe the firmament. Sometimes the moon is inviſible in a total eclipſe, even in a clear ſky, eſpecially when he is neareſt the earth, and paſſes through the centre of its ſhadow.

To recapitulate what has been explained upon the ſubject of eclipſes, we may make the following inferences: that an eclipſe of the ſun is nothing more than an interception of his light, by the dark body of the moon; that ſuch an obſcuration can happen *only* at the *change*, and then only in ſuch circumſtances as have been mentioned. That an eclipſe of the moon is occaſioned by her paſſage through the earth's ſhadow; that ſuch an eclipſe muſt happen at the full; and the reaſon why ſhe is *not* eclipſed at *every* full has already been ſufficiently explained.

As the moon's motion in her orbit is from weſt to eaſt, an eclipſe of the ſun generally begins on his weſterly edge; ſometimes on the north, and ſometimes on the ſouth ſide. This depends on a variety of circumſtances, ſuch as the time of day, the place from which the eclipſe is viewed, &c. But an eclipſe of the moon begins on her eaſterly edge; becauſe, as her progreſſive motion is continually in an eaſterly direction, ſhe muſt neceſſarily firſt touch the ſhadow on the weſterly ſide, by which means the obſcurity commences on her eaſterly limb.

CONCLUSIVE OBSERVATIONS.

"Eclipſes of the ſun are more frequent than thoſe of the moon; but we have more viſible eclipſes of the moon than of the ſun, becauſe a lunar eclipſe is ſeen from all thoſe places on the earth which are directed towards her." Conſequently an eclipſe of the moon may be ſeen by one half of the world at the ſame time. But an eclipſe of the ſun can be ſeen *only* at thoſe places, which lie in the paſſage of the moon's ſhadow. It is much like a cloud paſſing over the ſun, whilſt he is viſible to the adjacent country, and the ſun may be totally eclipſed at one place, and not the leaſt obſcurity be ſeen in another.

"The number of eclipſes in any year cannot be *leſs* than *two*, nor *more* than *ſeven*; the moſt uſual number is four, and it is very rare to have more than ſix." When there are only two eclipſes in a year, they are always both of the ſun; and when there are ſeven, four are of the ſun, and three of the moon.

A total eclipſe of the ſun can never happen at any time and place without the moon *then* appears larger than the ſun. It muſt alſo be attended with a concurrence of many other circumſtances; ſo that two total ſolar eclipſes may not happen at the ſame place for many centuries. There are upon record accounts of ſuch eclipſes which have been ſeen in different countries, and in different ages of the world.

"In aſtronomy, eclipſes of the moon are of great uſe in aſcertaining the periods of her motions, eſpecially ſuch eclipſes as are obſerved to be alike in all circumſtances, and have long intervals of time between them. In geography, the longitude of places may be found by eclipſes of the moon. In chronology, both ſolar and lunar eclipſes ſerve to determine the time of any paſt event: for there are ſo many particulars obſervable in every eclipſe, with reſpect

to its quantity, the places where it is viſible, if o the ſun, and the time of the day or night, that it is impoſſible there can be two ſolar eclipſes, in the courſe of many ages, which are exactly alike in all circumſtances."

From what has been explained upon the ſubject of eclipſes in the preceding pages, we may plainly ſee that every event in nature has a natural cauſe; and inſtead of being alarmed by groundleſs apprehenſions, we muſt be convinced that it is all the conſiſtent reſult of a well regulated frame; and that no operation in the viſible ſyſtem, however novel or incomprehenſible to us, is any digreſſion from that eſtabliſhed harmony which prevails in every part. It cannot be expected, that beings ſituated as we are, can have a perfect knowledge of the deſign of creation. There are effects produced in the heavens and in the earth, whoſe origin we cannot trace, and whoſe cauſes we cannot explore.

It is the advantage of the preſent age, that genius has been directed to its proper channel; and that it has involved in its progreſs the perfection of every art, the improvement of every ſcience; and which has made a delightful tranſition in the condition of ſociety, and in the face of things. As the common appearances in nature can generally be traced to natural and rational cauſes, we have reaſon to be thankful for the improvements and diſcoveries which have been made in univerſal knowledge; and which form a conſpicuous contraſt between the philoſophy of the preſent day, and the darkneſs of ſome of the preceding ages. And as our inquiries have hitherto been ſo ſucceſsful, there is reaſon to hope and believe, that the progreſs of ſcience in the preſent period will be ſuch, that poſterity will riſe up, and realize the improvements of the nineteenth century.

The following are ſome of the remarkable eclipſes which have been ſeen in New England within thirty years.

IN the year 1778, June 24th, there was a great eclipſe of the ſun. As ſeen from Boſton it was about 11 digits, the north ſide of the ſun being viſible in the middle of the eclipſe. Probably many perſons now living can remember this remarkable eclipſe, as it happened four days before the Monmouth battle. It was *total* in ſome parts of Connecticut, probably at New London. This is one of the largeſt eclipſes which has happened within the laſt hundred years.

In the year 1780, October 27, there was another great eclipſe. At Boſton, it was about 10 digits; but in ſome of the more northern towns it was much greater, and almoſt total.

In the year 1791, April 3d, there was another extraordinary eclipſe, being almoſt central at Boſton, and appearing like a luminous ring. This alſo is well remembered by many perſons. The laſt eclipſe of the ſun, which was viſible to us, was June 26, 1805, at ſun ſet.

In the year 1809, April 14, there will be another eclipſe of the ſun, about three digits at Boſton. It is the periodical return of the one which happened April 3d, 1791.

In 1811, Sept. 17, another large eclipſe may be expected, with an obſcurity of 10 digits. It will begin between 12 and 1 o'clock, and end about 4, in the afternoon; its whole duration will be more than 3 hours; and in ſome parts of New England it will appear like a luminous ring. This eclipſe is one of the greateſt which has happened for many years; and at the time will occaſion much gloom and obſcurity.

In the year 1808, there will be two total eclipſes of the moon, both of which will be viſible to us; alſo, two ſmaller eclipſes in the year 1809.

A Catalogue of ſome of the moſt remarkable Eclipſes of the Sun, which have been ſeen at different times, and in different places, before and ſince the Chriſtian Era.

Before Chriſt.	Eclipſes of the Sun ſeen at	Months and Days.	Quantity of the Eclipſe.
431	Athens	Auguſt 3d.	11 Digits*
424	do	March 20	9 do
404	do	September 2	8 1-2 do
403	Pekin	Auguſt 28	10 1-2 do
394	Gnide	Auguſt 13	11 do
364	Thebes	July 12	6 do
340	Zant	September 14	9 do
310	Sicily Iſland	Auguſt 14	10 1-2 do
217	Sardinia	February 11	9 do
190	Rome	March 13	11 do
188	do	July 16	10 1-2 do
104	do	July 18	11 3-4 do
60	Gibralter	March 16	Central
54	Canton	May 9	Total
51	Rome	March 7	9 Digits
36	do	May 19	6 1-2 do
29	Canton	January 5	12 do
28	Pekin	June 18	Total
26	Canton	October 23	11 1-4 Digits
2	do	February 1	11 1-2 do
Aft. Ch'ſt			
1	Pekin	June 10	11 1-2 Digits
27	Canton	July 22	Total
30	do	November 13	10 1-2 Digits
49	Pekin	May 20	10 do
53	Canton	March 8	11 do
237	Bologna	April 12	Total
290	Carthage	May 15	11 Digits

* A Digit is a twelfth part of the diameter of the ſun or moon.

After Chriſt.	Eclipſes of the Sun ſeen at	Months and Days.	Quantity of the Eclipſe.
334	Toledo	July 17	Central
348	Conſtantinople	October 8	8 Digits
484	do	January 13	10 do
540	London	June 19	8 do
602	Paris	Auguſt 12	11 1-3
644	do	November 5	10 do
718	Conſtantinople	June 3	Total
753	England	June 8	10 1-2 Digits
809	Paris	July 15	8 do
810	do	November 30	Total
812	Conſtantinople	May 14	9 Digits
813	Cappadocia	May 3	10 1-2 do
1016	Nimeguen	November 16	Total
1017	do	October 22	6 Digits
1023	London	January 23	11 do
1086	Conſtantinople	February 16	Total
1113	Jeruſalem	March 18	9 Digits
1124	London	Auguſt 10	10 do
1191	England	June 23	11 1-2 do
1194	London	April 22	6 1-2 do
1230	Naples	May 13	Total
1261	Vienna	March 31	9 Digits
1415	Wittemburg	June 6	Total
1433	do	June 17	Total
1438	do	September 18	8 Digits

THE END.