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Surprises in the Return-rates of Photons from a Mirror on the Moon

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Appendix

Calculation method for the monthly return rates

All Earth velocity components in the east-west direction in equatorial coordinates were set such that the displacement is zero in the direction α of the velocity. For the velocity of the Earth around the sun the maximum displacement is set at full moon.

In the first step only the trigonometric functions for one month were set (sin $(1.031^*(\alpha_i+30\ \ldots))$-sin $(1.031^*(\alpha_i\ldots)))$ with i=[0;11], to get the sum of return rates for the month i. The factor 1.031 is a transformation of the calendrical days to the number of Moon-days per year (365/354=1.031).

For the Earth around the Sun there is in March a shift of 21 days from the beginning of the month to the vernal equinox plus 2 or 1 missing days in February.

Beginning in April, Tangential velocity:

$V_{1i}=\cos(1.031^*(i^*30-23+30))-\cos(1.031^*(i^*30-23))$ with i=[0;11] month

Radial velocity:

$V_{1i}=\sin(1.031^*(i^*30-23+30))-\sin(1.031^*(i^*30-23)$

For the rotation of the Galaxy, 318.2 is the angle from the vernal equinox to the direction of this velocity at the position of the sun, where the hours and minutes (rectascension) are transformed into degrees for the trigonometric functions.

Tangential velocity:

$V_{2i} = \sin(1.031^*(i^*30-23+30)-318.2)-\sin(1.031^*(i^*30-23)-318.2)$

Radial velocity:

$V_{2i} = \cos(1.031^*(i^*30-23+30)-318.2)-\cos(1.031^*(i^*30-23)-318.2)$

The same procedure is valid for the other Earth-velocities in the Universe, where instead of 318.2 the angels to the directions of these velocities are entered.

In the next step these tangential velocities, multiplied with their cosine-velocity components in the equatorial coordinates, were added (v_t) and the radial components (v_r) as well (in units of 30 km/s):

V_t=2.9 (South-North)+0.0133 (Earth rotation)+1*around the Sun -0.4285*7*galactic rotation - 0.4*Sun to Apex+0.755*4*Galaxy to Andromeda-0.485*20.3*to the Great Attractor + 7.6*Residual velocity

The monthly representations can be built by adding v_t+v_r or using the Pythagoras $v\_t^2 + v\_r^2$ or by the geometric mean √(v_t*v_r), but the experience showed that the product $vt_i{}^*vr_i$ resulted in the best accordance to the pattern-structure of the measured data.

This product, multiplied by 2.55 seconds, was entered in a Gauss-distribution with the standard deviation of 4.3 km, the default value for these data, and then scaled up to the values of the data. To achieve the observed asymmetry a modulation-factor with the half angle was included that represents the fact that the temperatures are different in winter in summer or in the monthly calculations that the moon is above the ecliptic plane for half a month and below it for the other half of a month, starting at the vernal equinox. By the variation of the starting point of this term the correlation can be increased by 10%.

The displacement in the North-South is combined with a constant displacement per year. Now the variation of this one and the Residual displacement led to increasing correlation-coefficients until the maximum correlation of 0.998 was found. The result is demonstrated in Figure 4. The velocity in the North-South direction was found to be about 60 km/s and the Residual velocity at about 300 km/s.

Calculation method for the daily return rates for one month, 2007, 2012, 2015

The strategy for these calculations was to achieve a maximum correlation with the measured data. And this was possible by the change of the Residual displacement and the North-South-displacement plus a monthly constant every day. The beginning of the pattern within this range of full moons in these years after the vernal equinox is very sensitive. One must observe the pattern in a graphical representation to find the best shift for a match. Otherwise, the correlation could be around zero. The change of the North-South-component changes the distance between the peaks and the change of the Residual velocity changes the height of the peaks.

If the Earth-Moon axis points in the direction of velocity, there is no displacement. As these axes point in about the same direction the cosine component is not necessary.

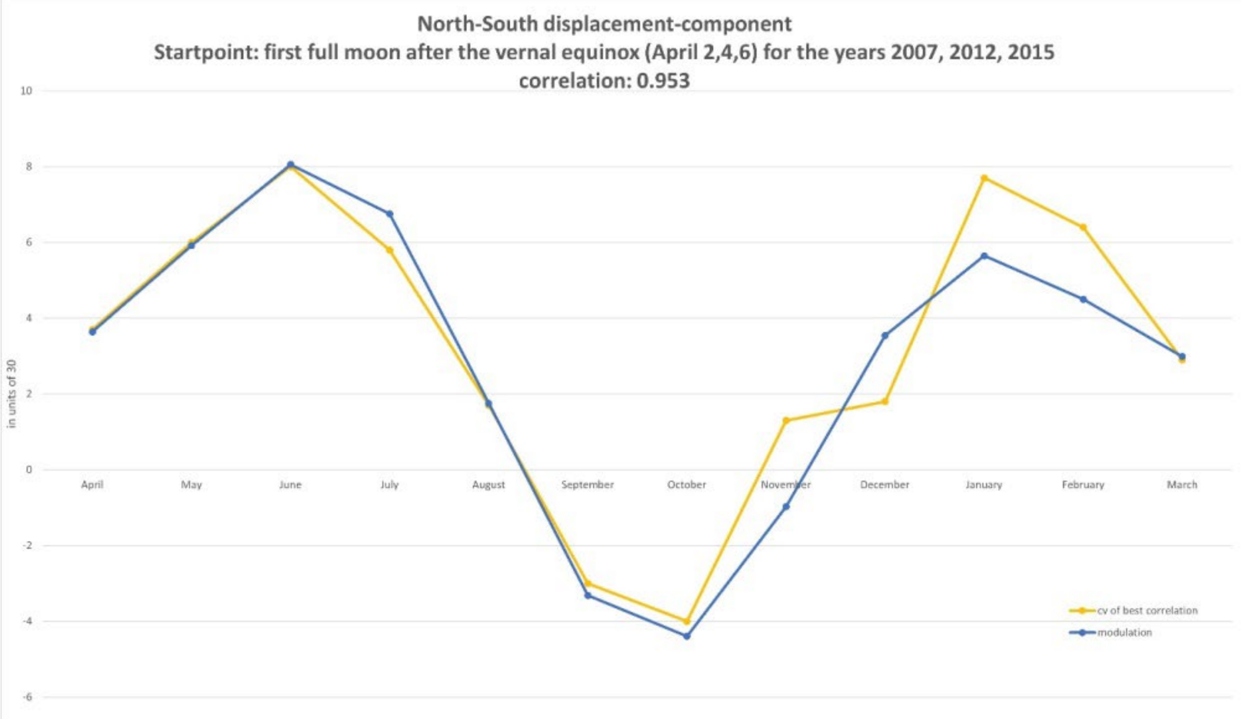
The angles in the sine-function are:

$\mathrm{Sin}\ (12.2^*(\alpha_i+11+[1;30]-[1;7])-d_i+0.9864^*(\alpha_i+11+[1;30])$

The factor 0.9864 is 360/365, the transformation of 365 days to 360°. The factor 12.19 is the transformation of 29.53 Moon-days to 360°. There are 11 days from the vernal equinox to the 1st of April, and d_i is the number of days on the 1st of every month i. The range [1;7] includes the days where one of the three full moons occurred after the vernal equinox (April 2.,4.,6.). α_i is increasing every month by 30.5°.

And this leads to the next surprise: The North-South displacements have a complex structure pattern as well.

For the calculation of the North-South component the declinations of the various velocities were used for the trigonometric functions, and these were multiplied with the sum of the former calculated displacement to get a similar course as in the calculated pattern. This is also necessary because the surface of Earth is always changing direction and flying in a non-East-West direction or vice versa both displacement components must be regarded. There is another surprise: the starting point for this pattern on the 4th of April led to a correlation of 95% with the calculated North-South displacements (Supplementary Figure 1).



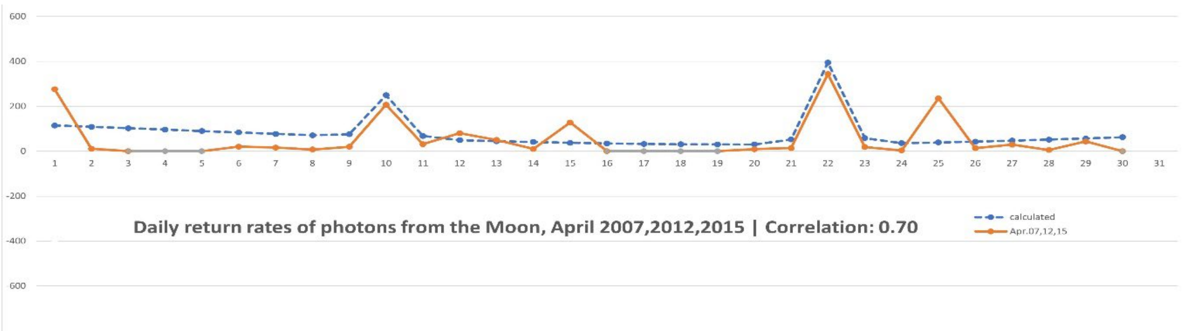
Supplementary Figure 1. North-South displacement-component start point: first full moon after the vernal equinox (April 2,4,6)for the year 2007,2012,2015 Correlation: 0.953.

But the empirical found values, by searching the highest correlation, seem to fit very well the calculated North-South-displacements. Therefore, the non-fitting points of the daily return rates were corrected to the calculated points for the North-South displacements. By this the correlation coefficients were decreased a little, but the total error of probability is still $<10^{-80}$.

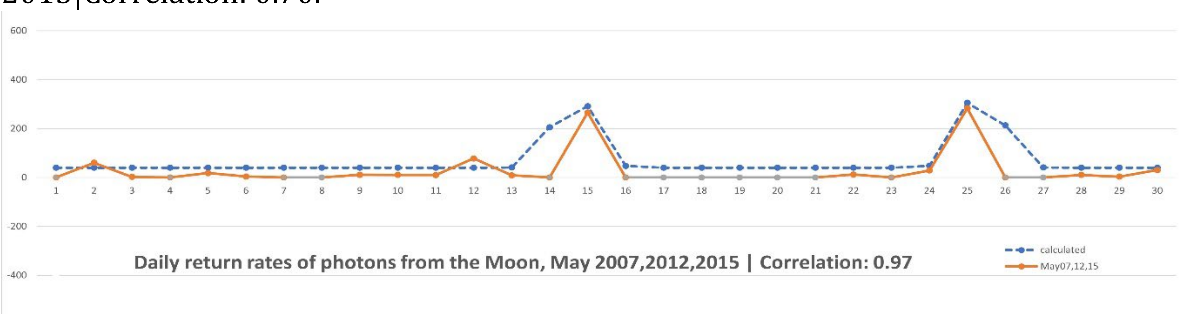
This combined displacement was again entered into the above-mentioned Gauss distribution and continued with the same procedure as described above. The pictures below show the matches and the correlation coefficients between the calculated rates and the measured rates.

The Excel files can be requested from the author.

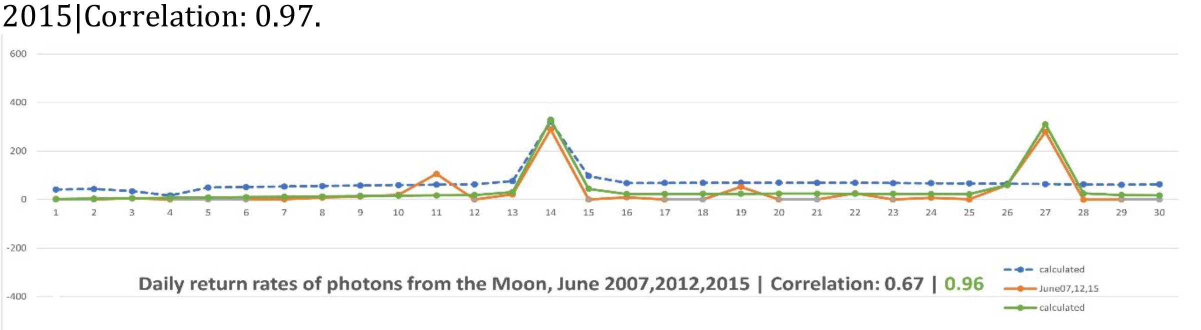
Comparison of the daily return rates of photons from the APOLLO15-mirror on the moon in the years 2007, 2012 and 2015, and the calculated return rates based on 8 velocities of Earth (Supplementary Figures 2-13). The gray dots mean: No measured data. Total error of probability for no correlation: <10^{-80}



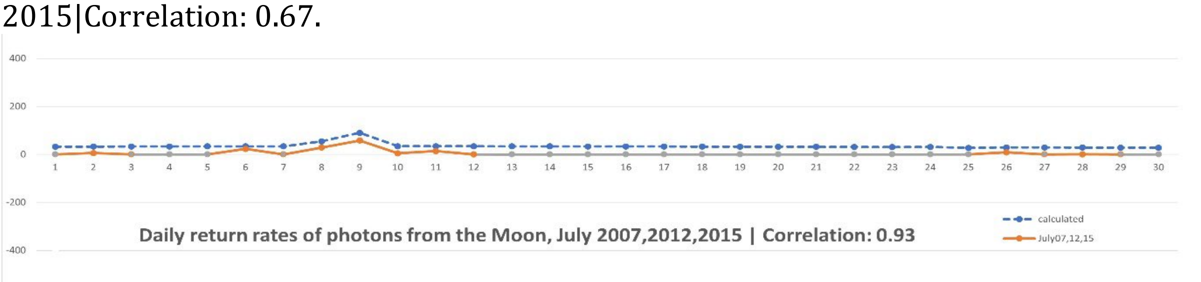
Supplementary Figure 2. Daily return rates of photons from the moon, april 2007, 2012, 2015|Correlation: 0.70.



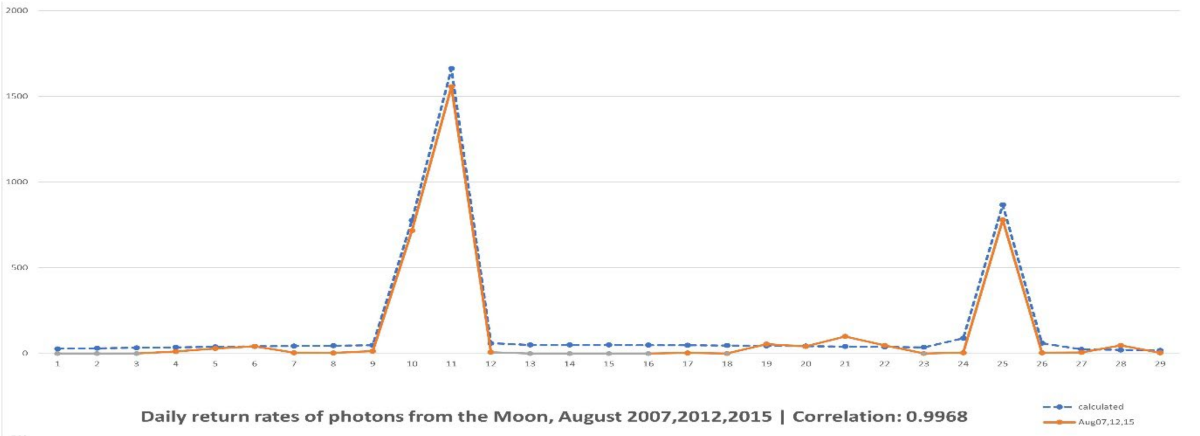
Supplementary Figure 3. Daily return rates of photons from the moon, may 2007, 2012, 2015|Correlation: 0.97.



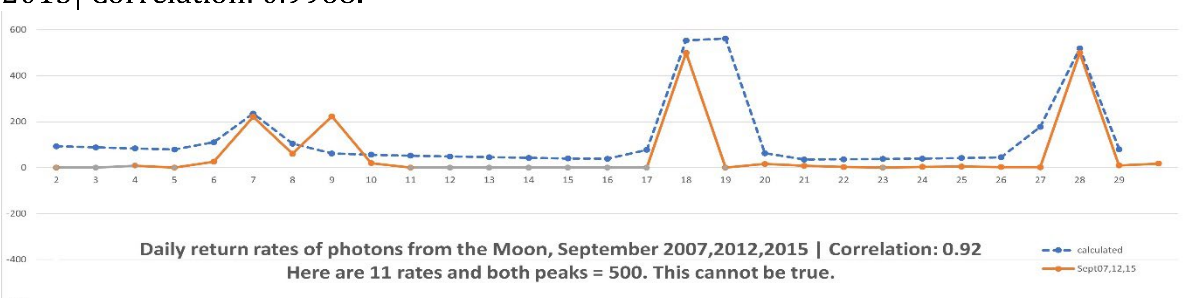
Supplementary Figure 4. Daily return rates of photons from the moon, june 2007, 2012, 2015|Correlation: 0.67.



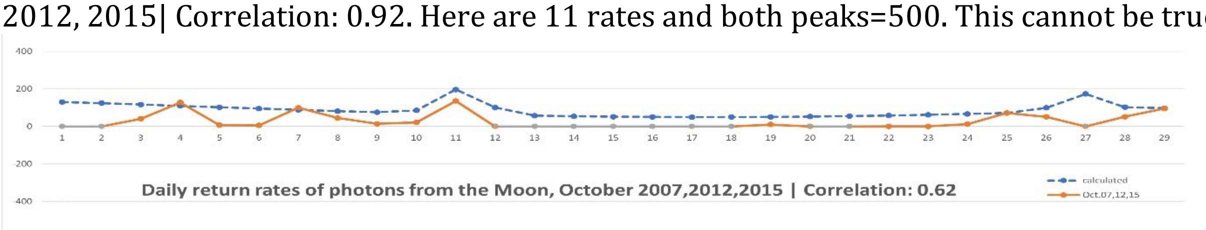
Supplementary Figure 5. Daily return rates of photons from the moon, july 2007, 2012, 2015|Correlation: 0.93.



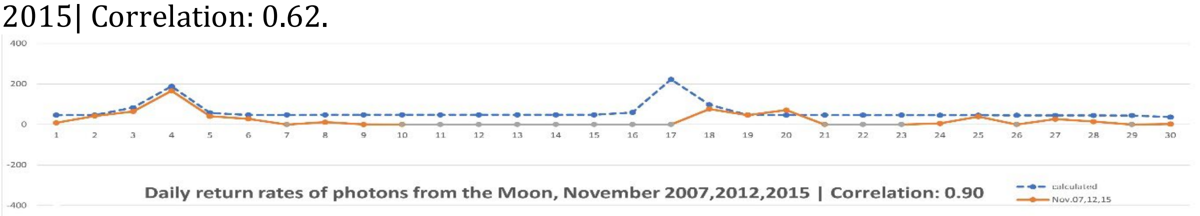
Supplementary Figure 6. Daily returns rates of photons from the moon, august 2007, 2012, 2015| Correlation: 0.9968.



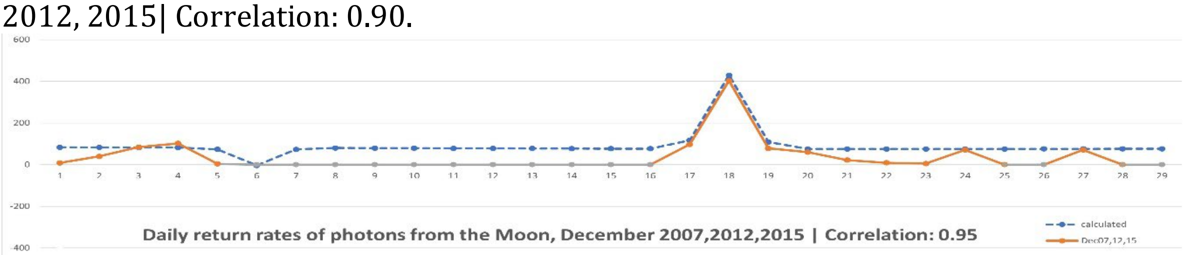
Supplementary Figure 7. Daily returns rates of photons from the moon, september 2007, 2012, 2015| Correlation: 0.92. Here are 11 rates and both peaks=500. This cannot be true.



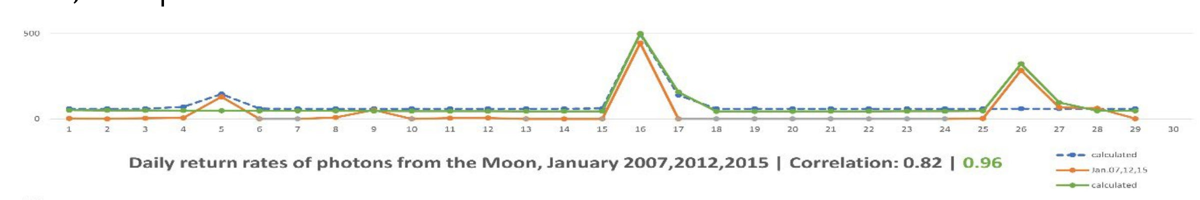
Supplementary Figure 8. Daily returns rates of photons from the moon, october 2007, 2012, 2015| Correlation: 0.62.



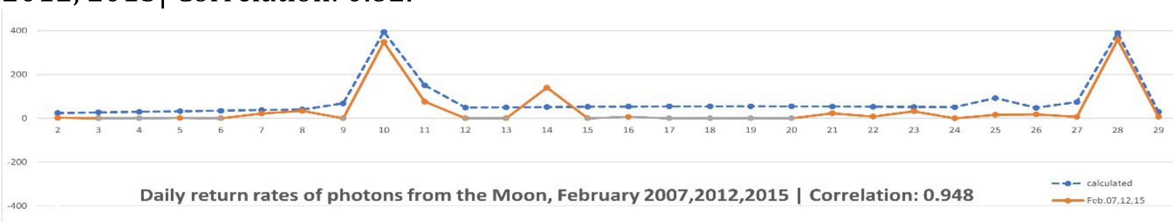
Supplementary Figure 9. Daily returns rates of photons from the moon, november 2007, 2012, 2015| Correlation: 0.90.



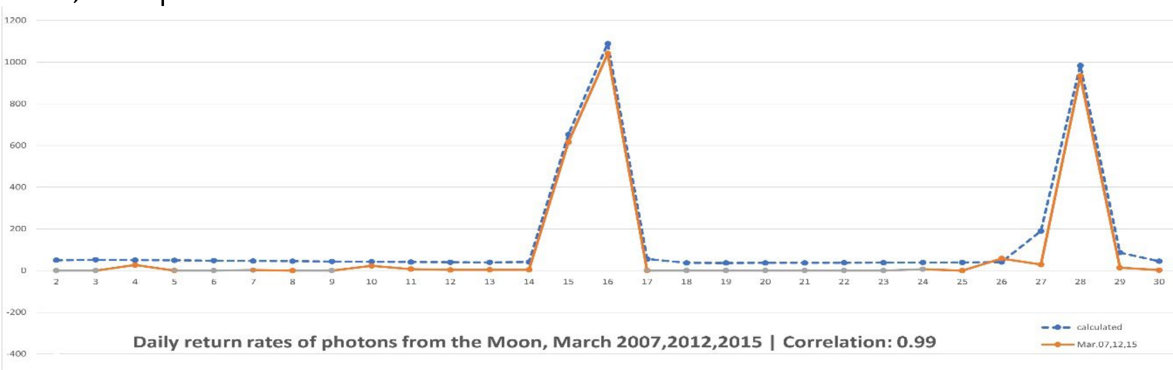
Supplementary Figure 10. Daily returns rates of photons from the moon, december 2007, 2012, 2015| Correlation: 0.95.



Supplementary Figure 11. Daily returns rates of photons from the moon, january 2007, 2012, 2015| Correlation: 0.82.



Supplementary Figure 12. Daily returns rates of photons from the moon, february 2007, 2012, 2015| Correlation: 0.948.



Supplementary Figure 13. Daily returns rates of photons from the moon, march 2007, 2012, 2015| Correlation: 0.99.