

Referee comment on "Earth Observations from the Moon surface: dependence on lunar libration" by Nick Gorkavyi et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2022-158-RC2>, 2022

General comments

This is a useful study, quantifying the Earth movement in the Moon sky, which can then be used to optimise Earth observations from the Moon. Based on this analysis, it emphasises the possibility of using a multi-slit based spectrograph, each slit associated with a different spectral range, and with a different position of the Earth in the sky.

Answer 1: The new version of the article contains a clarifying comment: "Each slit is directed to a unique position of the Earth in the Moon sky, but the spectral range of all slits is the same."

The authors should develop not only the advantage of a fixed observing platform on the Moon, but also the issues. For example, the libration is not always moving at the same speed, or following the same path (i.e. sometimes the Earth may not go through some of the slits; sometimes, it may stay on one slit, then return).

Answer 2: Most of the article is devoted to a discussion of the complex trajectory of the Earth, with accelerations, stops and returns. In the new version of the paper (part 4), the difficulties of comparing data from different slits, even if they work in the same spectral range, are discussed: "The angular velocity of a point on the Earth's surface in the field of view of the sensor is caused by two comparable factors: the rotation of the Earth around its axis and lunar libration, which causes a shift in the center of the Earth. The rotation of the Earth around its axis is a well-studied process, but librations of the center of the Earth in the lunar sky are poorly understood and raise many questions. When observing the Earth through the slit of the spectrometer, it will be necessary to take into account both the displacement of the center of the Earth and the Earth rotation."

Scanning different spectral ranges at different times may not be relevant to compare them.

Answer 3. All slits have the same spectral ranges (see Answer 1).

The quality of the graphs in the draft is poor, raster at around 140 dpi. For the final paper please use vector based graphics or raster of at least 300 dpi!

Answer 4. The quality of the figures in the new version has been substantially improved.

Specific comments

31 – Forward direction is around 0° , while backscatter direction is by definition around 180° .

Answer 5. In astronomy another definition of phase angle is used and the forward scattering is close to 180° deg – see "Phase_angle_(astronomy)" (Wiki)

Then, the phase angle cannot be between 2° and 12° . Also, why is starting at 2° and not at 0° ? In addition, why is that much anyway if the size of the Earth as seen from L1 is $< 1^\circ$. Even if these affirmations come from other papers, they seem so strange that the reader may question if they are true. Please be proactive and give more info (for example, by answering my questions above) to convince the reader.

Answer 6. An explanation has been added to the new version of the paper: “The phase angle interval from 2° to 12° is determined by the trajectory of the DSCOVR space observatory, which does not rest at the Lagrange point, but moves around it”. It is too ‘noisy’ to transmit data directly from the Earth-Sun line; thus, the phase angle is bigger than 2°.

81 – Still concerning the Figure 2, I know you had this one for a long time in the manuscript, but I realise now that it is misleading to have the Epic image as an “insert” of smaller dimensions. It suggests you may have such a large change in angular dimension of the Earth between LRO and Epic. I suppose the Earth angular size should be similar in both. Then I would rather suggest to put those pictures side by side in Fig 2, with the same size of Earth.

Answer 7. An explanation has been added: “The difference in distances Earth - Moon and Earth – L1 leads to the fact that a telescope with the same field of view sees the Earth with different angular sizes and resolutions”.

167 - Figure 6 was never introduced or discussed in the text. The figure should be introduced after its first mention.

Answer 8. Figure 6 has been removed.

243 – Here you give a definition of the “draconic month” different from that of line 100. They may be equivalent, but that is not necessarily obvious for the reader. Please use the same definition, or explain why the two definitions are equivalent.

Answer 9. Thanks for the helpful note. The definitions of the draconian and sidereal months were mistakenly swapped. They have now been corrected.

374 – I think you could remind in the conclusions more from your results that could be useful messages for the reader, like the statistics (density) of points, speed of libration etc. Otherwise, it looks as you didn't find much.

Answer 10. The conclusion section has been revised. In particular, the following items have been added:

“1. Due to lunar libration, the center of the Earth for an observer on the Moon moves in a rectangular area with dimensions of $13.4^\circ \times 15.8^\circ$. The density of the location of the Earth in this rectangular area is an average of 8.6 per square degree over 6 years (2191 days). The density for different parts of the area varies from 1 to 20.

2. The movement of the Earth in the sky of the Moon is characterized by quasi-periodicity with frequencies of ~27 days and 6 years. The rates of displacement of the Earth in the Moon sky reach two degrees per day. The shape of the Earth's trajectory changes from a circle to a straight line (see Figure 7).

3. Lunar libration must be taken into account when observing the Earth from the surface of the Moon and during Moon-Earth communications”.

Technical comments

1 – This comment is just an advice to avoid using “:” in the paper title “Earth Observations from the Moon surface: dependence 1 on lunar libration”. This is a special formatting character in Latex and it usually leads to errors when citing and referencing your paper.

Answer 11: Thank you

9 – “ $1.9^\circ \pm 0.1^\circ$ ” has to be in italic as well, if the entire Abstract is.

Answer 12: Fixed.

12 – Add: reaching “an amplitude of” 7.9° .

Answer 13: Added.

13 – Add: center of the Earth “to” move

Answer 14: Added.

53 – The resolution of Fig 1 is 142 pixels/inch and the journal requires minimum 300 pixels/inch. If those pictures are not available at higher resolution, you may increase by resample it artificially to respect the rule.

Answer 15. The quality of the figures has been improved.

81 – Same as for 53. I suspect your pdf maker was set to a lower resolution. Please check and, if true, increase its resolution rather than resampling the pictures.

Answer 16: See answer 15.

84-85 – I think you mean “a linear (one-dimensional) array of 5064 elements.” instead of “the linear (one-dimensional) array from 5064 elements.”

Answer 17: Fixed.

114 – Concerning “between $0.0255 \div 0.0775$ ”, I do not think the sign “ \div ” is correctly used. It is more for calling a “division”. You should better use “between 0.0255 and 0.0775”.

Answer 18: Fixed.

167 - Figure 6 is also of a too low resolution.

Answer 19. Figure 6 has been removed.

183 – Why do you have a break of line (row) here?

Answer 20. See answer 19.

191 – Replace “over a given point” with “above a given point”.

Answer 21: Fixed.

266 – You forgot the verb “is” N = 2191.

Answer 22: Fixed.

283 – You have to be consistent when calling the Figures 10-11 (as everywhere else), not Figs 10-11.

Answer 23: Done, thank you.

336-338 – Use Figure 7 not Fig. 7.

Answer 24: Done.

340-343 – Use Figure 12 not Fig. 12.

Answer 25: Done.

378-379 – “We suggest that proposed lightweight EPIC-Moon instrument on a fixed platform will provide the proof of concept” is ill formulated. May be you want to say “We suggest a lightweight EPIC-Moon instrument on a fixed platform to serve as a proof of concept”, or something similar.

Answer 26: Done, thank you.