

Reviewers' comments:

Reviewer #1: The paper presents interesting results on the transfer of the orbital mechanical momentum to a plasma from a circularly polarized laser light. The case considered in detail corresponds to a flat target with the transverse sizes smaller or comparable with the laser beam radius. The electrons are playing intermediate role: first acquiring the orbital momentum from the laser near the target surface and then transferring it to ions in the charge separation electric field. The necessary conditions for the momentum transfer are described and a dependence on the laser intensity, beam radius and the target density is discussed.

Moreover, another case is considered of a spiral target with the rotation axis parallel to the laser beam axis. In this case (already considered in the previous publication [3]) the orbital momentum transfer is due to the contribution of the light pressure. A comparison of these two cases is interesting and instructive for readers.

The paper is original and contains interesting results. However, revisions are necessary before the paper will be accepted for publication. There are three major points for improving:

- 1) the text is too much compressed and in many places it is difficult to understand what the authors want to say;
- 2) there are many figures in the paper but they are insufficiently commented,
- 3) the quality of figures is low: the lines and numbers are too faint and difficult to read;

We have increased the line width and font size in several figures.

- 4) the text needs to be revised by a native English-speaking person

Here are some particular comments:

- 1) The number 10^9 G for the magnetic field quoted in p.3 seems to be too big, please justify it

This value can be reached on the surface of overdense plasma (see Fig. 7). Now in the manuscript we mention that in underdense plasma it is on the order of MG.

- 2) The first sentence in sec 2, p.4 needs to be revised "... simulations were performed in VORPAL..."

It is corrected.

- 3) P.4: please use one notation for the laser frequency either ω_0 or ω_L

We use only ω_L .

- 4) P.7 explanation of fig.6 is not sufficiently comprehensible: what are "the electrons behind the electron bunch"? why they "will have a negative OAM" and why they cannot accelerate protons?

This part of the text is revised.

- 5) The role of magnetic fields in the electron bunch formation needs to be better explained and the figure 7 has to be better commented.

The magnetic field has a role in the electron bunching formation because it is necessary for the ponderomotive force to exist. The short-pulse structure observed in the magnetic field distribution is attributed to the coherent synchrotron radiation.

- 6) Explanation of the electron-ion coupling in the first paragraph of sec 2.2 in p.8 is not comprehensible: how can be "the electron oscillation amplitude much higher than the average one"?

This paragraph is also revised.

- 7) Still in p.8: fig.8 panels a and b present not contour plots but color plots; I cannot understand how the positive and negative parts of the OAM distribution were combined and how the panels c and d related to the panels a and b. The difference between the blue and green curves is not well explained and the curves are barely visible.

Now it is better explained.

- 8) The condition for the RPA regime in p.9 sec 2.3 needs to be better explained, it is not evident for a non-initiated reader

Now it is better explained. An article about RPA regime is cited.

- 9) Sec 3 on spiral targets needs to be better developed and expanded, figure 12 needs to be better commented. I do not understand what is presented in panel b.

This section is further improved and expanded. Detailed description of figure 12 is added in the text.

- 10) The conclusion in p.13 needs to be extended and, in particular, a long term plasma behavior after the end of the laser pulse needs to be commented.

The conclusion is extended by the description of long term behavior of the plasma.

- 11) The figures 14 - 16 are insufficiently commented

More description of the figures is added in the text .