

Title: The return of the merging galaxy subclusters of El Gordo? Manuscript ID: MN-14-3494-MJ  
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This paper is investigating the merger properties of the “El Gordo” merging cluster using a wide range of data set. Although the analysis sounds convincing, it would benefit of a better presentation so that the reader have a better understanding on the importance of various constraints. Once this is corrected, the paper can certaThe concept of time-since-pericenter is interesting, but it need to be clarified (the time at pericenter is only defined in section 3.3). I would suggest that you draw a diagram of the merger (may be at different time step) so that the reader can have a clearer idea of the geometry and evolution of the system (on the plot all the quantities used such as distances and velocities must be indicated).inly be accepted.

## Introduction:

more references on cluster merger and in particular regarding the typical speed of a merger should be given.

Accepted. This information is added on the 6th line of the introduction.

Figure 1 is key for the understanding of the paper. I would suggest to make it larger (by rotating it by  $\sim 45$ -50 deg in order to have the elongation axis of the cluster horizontal)

We have made the plot significantly larger.

showing possibly the galaxy luminosity contours.

We have an overplotting issue if the galaxy luminosity is added.

Can the relic radio data be plotted on top instead of some schematic of it? (it looks like the size of the relic does not match the size given in Lindner et al 2014).

We asked Robert Lindner for the relic contour but have not received any reply. The relic size depends on which wavelength of the radio relic image you are looking at. We referred to Figure 5 and Figure 8 in Lindner et al. 2014 for estimating the extent of the radio relic and have double checked that the extent are consistent.

The concept of time-since-pericenter is interesting, but it need to be clarified (the time at pericenter is only defined in section 3.3).

A brief definition is added to line 10 of P.3 of the paper.

I would suggest that you draw a diagram of the merger (may be at different time step) so that the reader can have a clearer idea of the geometry and evolution of the system (on the plot all the quantities used such as distances and velocities must be indicated). There you can also define what are the different merger scenarios that will thereafter discussed (the outgoing and the returning scenario). At the moment, the reader needs to go through the literature to understand what are the effective geometric assumptions used.

Accepted. To be implmented.

## Section 2

The presentation of the data is not fully quantitative. A table is given for the WL data, but the paper is also using the radio data relic, and a summary table would be great. This table should underline the key number from the radio data used in the analysis (position, Mach Number/velocity?, polarisation? ...)

The radio data are not inputs like the other data in Table 1. Table 1 only specifies the initial conditions that we used for the Monte Carlo simulation for computing the output parameter estimates.

The radio data help the simulation in two ways: 1) determine the Monte Carlo weights to the inputs this is specified fully in section 3.3 2) calculate the probability of the two merger scenarios, this is specified fully in section 3.4

What about the velocity data? It is described in section 3.1.1 but should it not be moved to section 2?

Accepted. To be implemented. We have moved some of the descriptions to section 2.

## Section 3

I believe the vector D is representing the data, but this could be clearer, and it would be good to clarify which data is effectively used. Table 1 seems to only give part of the data used in the analysis.

We have added descriptions in Table 1 for clarification.

It would be helpful to describe a little bit more the MC simulation code. Does the simulation use a large number of particles? Or is it just using 2 “particles” with a NFW mass profile. It would be good to remind the reader of some of the key element in D13.

Accepted. To be implemented.

Are the galaxies introduces as test particles in the simulations? It seems not, but would this be a way to better model and possibly constraints the merger? I computed a  $\Delta v_{\text{rad}}$  of 463 km/s (based on the 2 redshift: 0.8684 and 0.8713) instead of the number of 476km/s given in the text, can you explain why?

We thank the referee for double-checking our calculation. The calculations that led to the results were done with the entire PDFs, then we take the biweight location as the estimate. In the referee’s calculation, only the best estimate was used, therefore, the discrepancies arise from the different inputs. Also, the uncertainty that we give is much bigger than this discrepancy.

Similarly the  $d_{\text{proj}}$  I found is 0.744 instead of .74 (based on the RA, DEC given)

We also used the full PDFs for computing  $d_{\text{proj}}$  which is a more robust calculation.

It would be much better to define the output parameters using a diagram of the different merger scenarios.

Would there be a correlation between beta and TSP?

No. The parameter  $\beta$  is not a property, nor an output of each Monte Carlo simulation, it is a choice of parametrization of our uncertainty, i.e. you cannot find one  $\beta$  value for each simulation so you cannot compute a correlation between  $\beta$  and  $TSP$ , since  $TSP$  is an output and has one value for each Monte Carlo simulation.

## Section 4

It would be good to move some of the key likelihood plot from the annex to the main text. Indeed, the start of section 4, starts with results that are basically described in the appendix, which is not ideal.

Which specific likelihood plot would you like to see in the main text?

## Section 5

For the comparison with other analysis, I would suggest that the author summarizes the comparison in two tables. One table comparing results with other El Gordo modelling.

The hydrodynamical simulations do not directly give estimates for most of the output parameters that we have. If we try to compute a table, a lot of the entries from the hydrodynamical simulations will be empty or rough estimates that are taken from some of their plots.

And one table comparing the properties of the different merger described with the same modelling principle, in particular comparing El Gordo to the bullet cluster and the musket cluster.

Accepted. To be implemented in the appendix.

Written with [StackEdit](#).