Response to SCI-Post editors

H. D. Parischewsky et al.

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We thank the reviewer very kindly for the suggestions for improvement for our paper, which we have now incorporated. All changes to the actual paper have been highlighted in red-faced font, and we respond directly to each comment below. We think the reviewer's suggested edits have greatly improved the paper, and hope you will agree that it is now ready for acceptance.

- 1. Page 2: It would be more accurate to say that "More than a century passed", instead of "Many centuries passed".

  Response: We have now done this in the indicated sections, with our edit indicated in red-faced font.

- 2. Page 14: Authors point out that that regular regions appear at approximately regular intervals. Is there a simple explanation for this behavior? Is it possible to derive an analytical expression for the location of these regular regions?

  Response: We think that the repeating zones correspond to commensurabilities in the ratio between the distance of the closest pair of particles and their distance to the third particle, but this will require detailed modelling and testing. Hence, a simple explanation and a corresponding analytic solution will be the focus of future work.

- 3. I wanted to make sure I understood Figure 6 correctly. In the panel g, it looks like all the particles are grey, meaning that these systems ended in mergers. It is my understanding that these systems belong to binary-single regime. Since, you are simulating 1 solar mass objects for 10^5 years, it looks like the binary components need to be very close $(a1\ 10^{-}3AU)$ for them to merge within the integration time. Are all binary separations in panel g this close?

  Response: Indeed, we are working with particles who start close enough to merge within the integration time. We select the triangles with the closest initial binary pair and display their distances in the next table.

  Panel g can be coloured by the length of the sides, thus we can appreciate how the distance between P2 and P3 (i.e, S1)

S1	Pair 2+3	0.018438532142863426 au
S2	Pair 1+3	0.015600053906359181 au
S3	Pair 1+2	0.0013882164321073413 au

Table 1: Smallest side distance between all the triangles we generate. This data set corresponds to simulations with post-Newtonian corrections turned on (i.e, **Set C**).

diminishes at the limit of 0.01843AU. We can see this in the following plot:

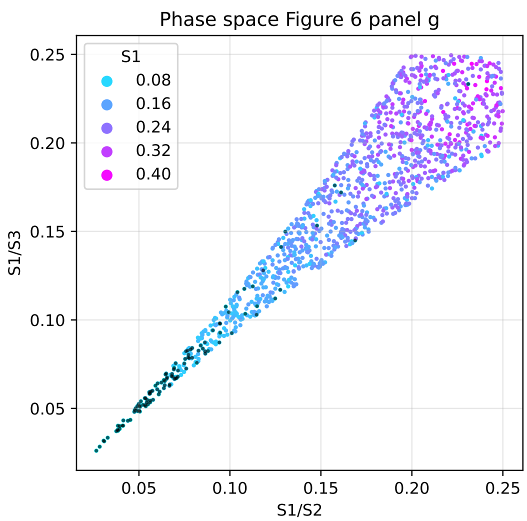

Figure 1: Phase space plot corresponding to panel g. Black dots represent the triangles where the distance between the closest particles is less than $9 \times 10^{-}3AU$.

Moreover, when the binary pair begins the gravitational wave inspiral, it the integrator takes many steps to integrate until they merge requiring more and more CPU time. To reduce the running time, we choose each particle collision radius to be equal to 500 Schwarzschild radii (see section 3.4). This is why many simulations are labelled as merger even before reaching $\sim 10^{-3}$ au.

- 4. In the Section 5.2 where the authors describe post-newtonian results, it should also be noted that while newtonian results are scale invariant, post-newtonian results are not. More specifically, the results from these simulations cannot be directly applied to other systems with different of masses.

Response: We add the next paragraph at the end of section 5.2 . "We caution that Newtonian gravity is scale invariant whereas post-Newtonian gravity is not. Hence we do not extend our results to systems with different particle masses".

- 5. Page14, Section 5.3.1: Typo: The top panel of Figure 7 does not show binary energies. It would be great if authors could comment and describe each panel of the figure. Also, It is not clear if the bottom row is necessary as the theoretical predictions can be plot on similar plots in the first two rows.

  Response: We have removed the "of binary energies" for the mentioned section.
  The bottom row of Figure 7 represent the direct comparison in between the results we obtain and the Valtonen & Kartunen experimental integrations. They just use ergodic subset to their porpoises, that is why we contrast in a separate row. We add to section 5.3.1 a brief explanation and comments for each one of the panels for the Figure.

- 6. It looks like Figure 9 and Section 5.3.4 would work better in Section 5.1 where authors describe the results of simulations.

  Response: We moved the section called 'Ergodic and regular phase space' at the end of section 5.1 and the Figure 9 has moved too and now is Figure 6.

- 7. Section 6.1.2: It is not clear how authors can conclude that the binaries formed from 3-body interactions in isotropic star clusters would rapidly coalesce. Since post-Newtonian results are not scale invariant, results from the simulations done in this work may not always be applicable. For instance, many low mass stars can take billions of years to merge even at smaller separations.

  Response: As found in Reinoso et al. 2022 (see their fig. 2) via N-body simulations, once binaries form in such high density environments they are rapidly perturbed by neighbours, and experience a random walk in eccentricity that rapidly leads to a merger. Hence the presence of tertiary perturbers is responsible for driving the rapid coalescence. In any case, depending on the scale of the system, even the high eccentricity might not be enough to merge a binary (as the referee correctly points out, post-Newtonian gravity is not scale free). Therefore a cautionary note at the end of Section 6.1.2.