

Review of Pravec et al., pairs and binaries

When I received this manuscript to review, one of the first things I did was scroll to the end to discover it runs 210 pages! It was only after getting into reading that I discovered 210 pages is just the supplementary material, the main manuscript and appendices are another 105 pages, or 315 pages total! Well, I have now read the main manuscript and the three appendices, but not the entire supplementary material. I will trust the supplementary material is in order and did not read it all in detail. Perhaps it would be good to number the supplementary pages S1, S2, up to S210, to distinguish from the page numbering of the main manuscript. Be that as it may, the content of this giant work well justifies the length of the presentation, I have no suggestions for cutting the volume. I think the figures are all well justified and important, although there is some arbitrariness in which are presented in the main manuscript and which relegated to the supplementary material. Perhaps that could be clarified a bit in the introductory text. Most of my comments that follow are just suggestions, not required corrections; in general the paper is very well organized and presented.

In general the English language usage is quite good, but there are some cases where phrases should be checked (or I could say “un-Czech-ed”) by a native English-speaking author, perhaps Dan Scheeres would be the best one to do this.

p. 7, line 15, I’m not sure understand the limits for velocity and separation. As written it is at best ambiguous, does “5 – 10R_{Hill}” mean “five minus ten” or a range “five to ten,” or something else? If I understand what seems to be suggested in the text that follows, what is meant is that for younger pairs, the constants 5 and 2 are used, for older families, 4 and 10. If that is correct, then maybe what should be written is “ $r_{\text{rel}} \leq (5 \text{ or } 10)R_{\text{Hill}}$ and $v_{\text{rel}} \leq (2 \text{ or } 4)v_{\text{esc}}$,” followed by the explanation of when the smaller or larger constants are taken.

p. 8, top paragraph above Sect. 3, the age estimation and uncertainty range are well described, and tabulated in Table 1. Since the error ranges vary so much case to case, and are sometimes highly asymmetric, it would be good to list the uncertainty ranges in the text wherever the estimated (50th percentile) age is stated. Perhaps the histogram plots could have arrows indicating the minimum, median, and maximum values of age.

p. 28, sect. 3.11, P1, “ $p = 3.0108 \pm 0.0003 \text{ h} \dots$ ” units missing; p. 30, sect. 3.14, “orbital period $81.19 \pm 0.02 \text{ h} \dots$ ” units missing. There are no doubt other cases, I have not checked all carefully. All text should be checked for missing units.

Some of the encounter histograms (e.g., Fig. 23) are presented in the main paper, while others are relegated to Suppl. Why? Perhaps all but a sample of a couple could be moved to Suppl., plus those with anomalous shapes, e.g. Figs. 12, 22.

p. 50, sect. 3.31, a word or two missing, maybe should read “...high estimated separation time of about 1 Myr...”

In Fig. 52, p. 61, the albedo scale and binning might be better in, well, geometric units. With the linear units used, a bin width of 0.03 at albedo 0.06 spans a factor of 2 in albedo, whereas at 0.5

albedo, 0.03 is only a width of about 6% albedo. The numbers are so low at the extremes that maybe it hardly matters, but I'd suggest about ten bins spanning from .05 to .5 with bin widths of a factor of ~ 1.25 , e.g. bin boundaries at .050 .063 .079 .100 .126 .158 .199 .251 .316 .397 .500.

Fig. 54, p. 62, and description on p. 60, it is indicated that the albedos and colors plotted are for the primary object. In cases where you have the data (either albedo, color, or both), it would be good to plot in some way the data for secondaries, to show that they are close to the same, or note where they aren't.

p. 74, description of Fig. 59, mention the Maclaurin and Jacobi plot lines, maybe text could read "Also plotted are the size ratios of the Maclaurin (green line at top) and Jacobi (purple curve) ellipsoids."

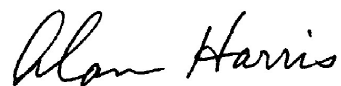
In Appendix A, p. 87, It might be good to define the columns in Table A.1 before discussing the details for the asteroids. In particular, χ^2_{red} is mentioned for the solutions before it is defined in the table description, and in fact is not really defined at all. It would be good to define just what χ^2_{red} is a measure of, and also the column D ; what measure is that based on? And lastly, presumably the ten or so measurements of each of the asteroids were taken over some range of time. Did you back-compute the rotational view at the times of the observations for the TPM?

In appendix C, p.95, is the given probability of a spurious match that of any one individual asteroid having another asteroid that close in element space, or is the probability that any one out of the 100,000 or more would have another asteroid that closely matched? That needs to be stated clearly, and if it is the probability that any one asteroid will have another that close, then of course one should expect out of 100,000 there should be many spurious matches at the 1-5% probability level, and even below.

I have scanned the first 30 or so pages of the supplementary material, and it looks pretty much in order. My only comment is that it is not clear how choices are made as to what to put in supplementary and what to put in the main paper. I found Sup. Figs. 1 and 2, the plots of pole positions for (2110) and (44612), quite revealing and showed clearly that the poles differ mainly by precession to their current positions. I think including these in the main text might be good both for making this point and for including at least one pair of pole position plots in the main paper.

In conclusion, I congratulate the authors on a monumental work and a generally fine presentation. Essentially all of my comments above are "just suggestions", not really pointing out errors or deficiencies of significance.

I do not request anonymity and sign my review.



Alan Harris