

Erratum: Protoplanetary disc evolution affected by star-disc interactions in young stellar clusters

by Giovanni P. Rosotti,¹★ James E. Dale,² Maria de Juan Ovelar,³
David A. Hubber,^{4,5} J. M. Diederik Kruijssen,⁶ Barbara Ercolano⁴
and Stefanie Walch⁷

¹*Institute of Astronomy, University of Cambridge, Madingley Road, Cambridge, CB3 0HA, UK*

²*Centre for Astrophysics Research, Science and Technology Research Institute, University of Hertfordshire, Hatfield AL10 9AB, UK*

³*Astrophysics Research Institute, Liverpool John Moores University, 146 Brownlow Hill, Liverpool, L3 5RF, UK*

⁴*Universitäts-Sternwarte München, Scheinerstraße 1, D-81679 München, Germany*

⁵*Excellence Cluster Universe, Boltzmannstr. 2, D-85748 Garching, Germany*

⁶*Astronomisches Rechen-Institut, Zentrum für Astronomie der Universität Heidelberg, Mönchhofstraße 12-14, D-69120 Heidelberg, Germany*

⁷*I. Physikalisches Institut, Universität zu Köln, Zùlpicher Str. 77, D-50937 Köln, Germany*

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The paper ‘Protoplanetary disc evolution affected by star-disc interactions in young stellar clusters’ was published in MNRAS, 441(3), 2094 (2014). While performing a follow-up investigation, we discovered a subtle error in the algorithm we used for determining disc sizes. As explained in section 3.1 of the paper, discs sizes were determined by first identifying the orbital plane of the disc, then projecting the particle positions on the orbital plane, and lastly by computing the half-mass radius in the plane. To identify the plane, we computed and diagonalised the inertia tensor. Unfortunately, we found that the inertia tensor, due to the r^2 scaling, in some occasions can be dominated by only a few particles at significant distance from the star. In this case the plane identified by the algorithm does not coincide with the true orbital plane of the disc. This leads to a systematic underestimate in the projected distances of the particles of a factor $\cos \theta_{\text{err}}$, where θ_{err} is the angle between the inclination of the orbital plane as reported by the algorithm and the correct one.

We re-analysed the simulations in the paper excluding very distant particles. In general, we find that the error did not affect our conclusions regarding simulations R10 and R30, in which we found the disc sizes to be compatible with disc truncation by the closest encounter (see Fig. 11 and section 4.1 in the paper). Nevertheless, the error did affect individual disc radii, and for this reason we plot in Fig. 1 the final disc radius in simulation R10 as a function of the closest encounter distance (this figure replaces the right panel of Fig. 5 in the paper), to show that once we correct for the error we get a tighter correlation between the disc radius and the distance of the closest encounter.

The new radii affect instead our conclusions regarding simulations R100 and R300. In the paper we reported that the disc median size in these two simulations reached a steady state with time, which we interpreted as an effect of distant encounters. In Fig. 2 we plot the evolution of the median disc size versus time (this figure replaces Fig. 7 in the paper). It can now be seen that, differently from the conclusion reached in the paper, the encounters have little effect on the median disc size.

* E-mail: rosotti@ast.cam.ac.uk

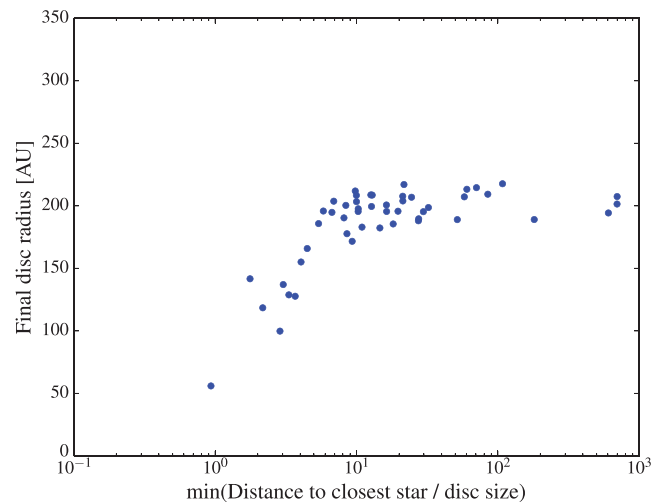


Figure 1. The final disc size in simulation R10 versus the distance of the closest encounter; this figure replaces the right panel of Fig. 5 in the original paper. Note how after correcting for the error we now get a much tighter correlation between final disc size and the distance of the closest encounter.

This can be seen in more detail in Fig. 3 where we plot the histogram of the disc sizes for these two simulations (this figure replaces the relevant panels of Fig. 8 in the paper). Note that most disc sizes are similar to the value in isolation (shown by the vertical red line).

Additionally, in Fig. 4 (replacing the right hand panel of Fig. 9 in the paper for simulations R100 and R300) it is clear that the final disc size is set by the closest encounter, as is the case for the other simulations R10 and R30, and it is not necessary to invoke the effect of distant encounters. It is also important to note that no disc has been affected by encounters if the distance of the closest encounter is greater than ~ 5 times the disc size, in contrast to the paper where we reported that in the simulation R300 some discs were affected even if the distance of the closest encounter was as much as a few tens times the disc size.

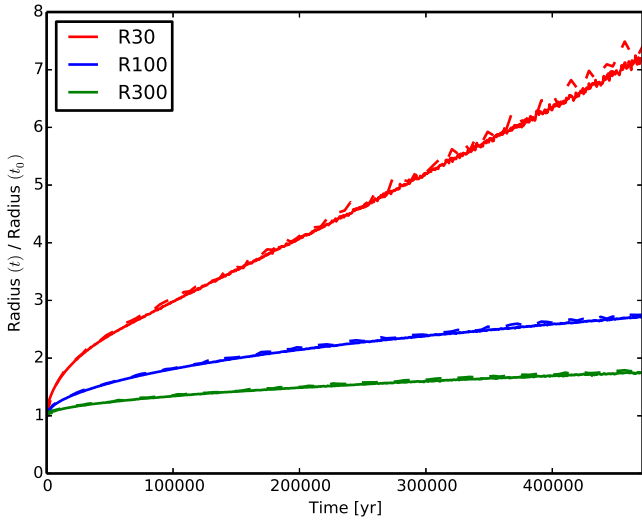


Figure 2. Evolution of the median radius with time for simulations R30, R100 and R300; this figure replaces Fig. 7 in the original paper. The encounters have little effect on the median disc size for all the simulations shown.

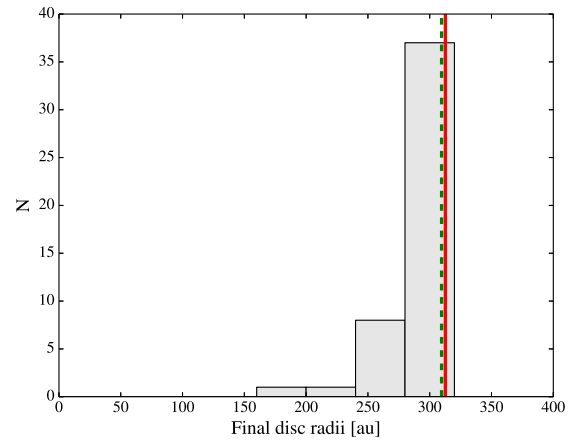
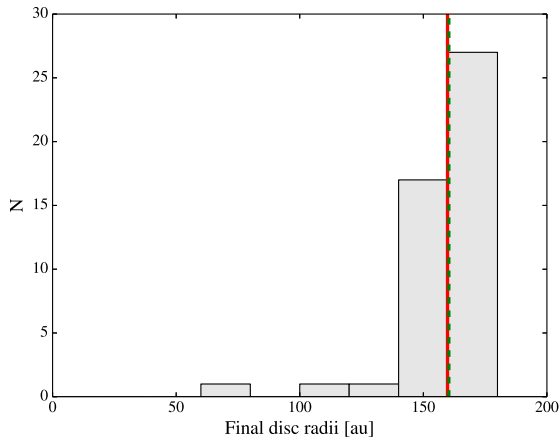


Figure 3. Histograms showing the disc sizes at the end of the simulation for simulation R100 (left panel) and R300 (right panel); this figure replaces the relevant panels of Fig. 8 in the paper. Most disc sizes are similar to the value in isolation.

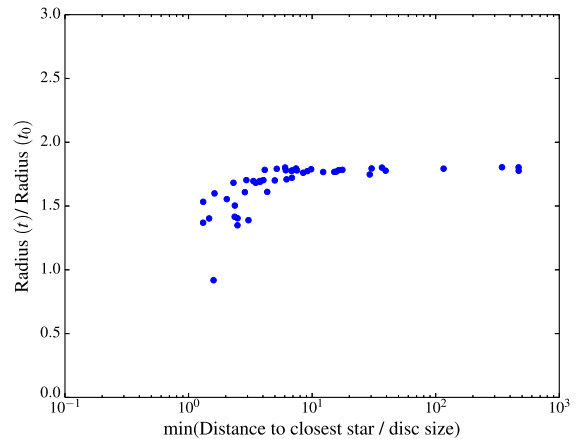
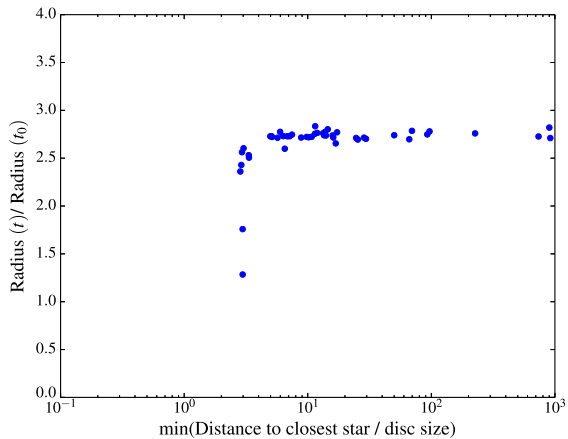


Figure 4. The final disc size for simulation R100 (left panel) and R300 (right panel); this figure replaces the relevant panels of Fig. 9 in the paper. The disc size now has a stronger correlation with the distance of the closest encounter.

To further show this point, we have also re-analysed the simulations in light of the simple theoretical model presented in section 4.1 of the paper. We plot in Fig. 5 (which replaces the relevant panels of Fig. 11 in the paper) the results. It can now be seen that the intermediate regime reported in the paper of ‘discs that had only distant encounters, but which nevertheless are smaller than the disc run in isolation’ is no longer present.

The claim reported in the conclusions and in the abstract that ‘we find a regime where distant encounters can have a significant impact on the discs’ is therefore not valid anymore; the correlation between the disc size and the distance of the closest encounter implies that the closest encounter is the only one that matters in setting the disc size. The other conclusions in the paper remain unaffected. In particular, the error we have identified does not affect in any way the disc masses. We have also verified our conclusion that there is a cut-off in disc radii at high stellar densities (Fig. 13 of the paper) is not affected since this is driven by the closest encounters.

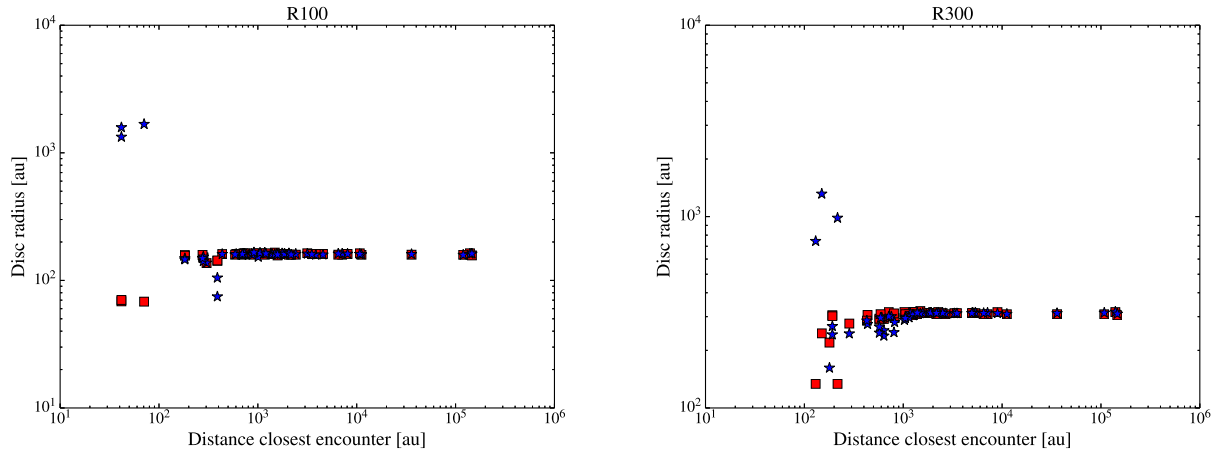


Figure 5. Comparison between the predicted disc sizes by the model (red squares) from section 4.1 of the paper and the results from the simulation (blue stars) for simulation R100 (left panel) and R300 (right panel); this figure replaces the relevant panels of Fig. 11 in the paper.

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