

Pebble-driven migration of low-mass planets in the 2D regime of pebble accretion (Corrigendum)

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We report problematic behaviour in the empirical scaling law used in Chrenko et al. (2024) to fit the dependence of the pebble torque Γ_p , as measured in our simulations, on the Stokes number St and the planet-to-star mass ratio q . The scaling law defined by Eqs. (14)–(18) of our original article exhibits a discontinuity in the interval $0.38 \lesssim St \lesssim 0.55$, where the fitting function becomes constant and independent of St . We failed to notice this discrepancy in Fig. 5 because the horizontal axis was sampled too sparsely: we used discrete St values corresponding directly to the individual simulation runs, and our plotting routine automatically connected these data points with line segments. The grey curves in Fig. 1 (analogous to Fig. 5 in the original article) reveal the problematic feature when the true behaviour of the original fitting function is reconstructed.

Since the main purpose of our scaling law is to enable the implementation of the pebble torque in models with prescribed migration forces, any abrupt jump in Γ_p is undesired, even though the affected region of the parameter space is small. To remedy this, we propose the following improved fitting function:

$$\frac{\Gamma_p}{\Gamma_0} = \frac{Z}{0.01} h^{-0.45} St^{-19h} \min[\Gamma_3, \max(\Gamma_2, \Gamma_1)], \quad (1)$$

together with

$$\begin{aligned} \Gamma_1 &= 5.909 \times 10^{-3} St^{3.595} q^{(-0.479+0.2 \log St)}, \\ \Gamma_2 &= 5.195 \times 10^{-4} St^{1.05} q^{(-0.713-0.052 \log St)}, \\ \Gamma_3 &= 1.463 \times 10^{-6} St^{-5.136} q^{(-1.074-0.311 \log St)}. \end{aligned} \quad (2)$$

Equations (1) and (2) are intended to replace Eqs. (16)–(18) of our original article. A replacement of Eqs. (14)–(16) can be readily obtained by dropping the factor $h^{-0.45} St^{-19h}$ from Eq. (1) and multiplying Eq. (2) by $0.05^{-0.45} St^{-0.95}$.

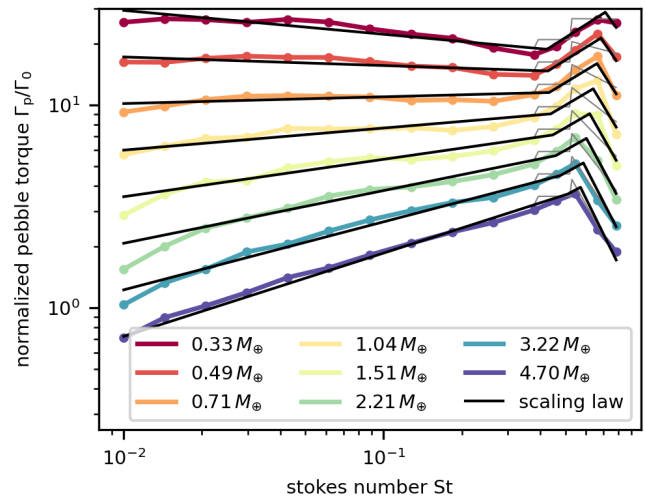


Fig. 1. As Fig. 5 of Chrenko et al. (2024), with the black curves corresponding to the updated fitting function (Eqs. (1) and (2)). The original fitting function, which contains an undesired jump, is shown with the grey curves.

The conclusions and results of Chrenko et al. (2024) remain unchanged. The purpose of this corrigendum is solely to prevent spurious behaviour in future models that employ our scaling law.

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References

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