Literature Values Search

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1 Escape Velocity from Dust Disk

Turekian (2014), in Section 6.1.2.2, gives an escape velocity in relation to a gravitational focusing factor. See Equation 1.

$$F_g = 1 + \frac{v_{esc}^2}{v_{rel}^2} \tag{1}$$

In Equation 1, v_{esc} is the body's escape velocity, and v_{rel} is the escape velocity of other particles in the body's environment.

It is unclear whether this is the right approach. Can a dust disk be considered a 'body' in this context?

2 Lifetime of Biological Material on Rocks in Space

Ginsburg et al. (2018) gives

$$f_{survived} = e^{-\frac{t}{\tau_{bio}}} \tag{2}$$

In Equation 2, τ_{bio} is the biological lifetime, and t is the time the biological material spends inside the rock.

Adams & Napier (2022) looks promising. It gives a distribution of rocky objects by mass:

$$\frac{dN}{dm} = Am^{-p} \tag{3}$$

In Equation 3, m is the mass, N is the number of rocks, and p has values between 1 and 2. When the size-mass distribution is 'determined by collisional processes', $p \approx 1.8$. This can be linked to rock radius if we have an assumed density for these rocks. A is defined in Adams & Napier (2022).

`https://astrostatistics.psu.edu/datasets/asteroid_dens.html#:~:text=However%2C%20the%20internal%20structure%20of,structures%20will%20have%20lower%20density.` gives a density of asteroids ('Oumuamua is said to have the same density – see the Wikipedia page) of 3–5 gcm^{-3}.

Adams & Napier (2022) gives a minimum mass for the rocks to harbour biological life as 10 kg.

Adams & Napier (2022) also gives a minimum rock size for the rocks to harbour biological life as a few centimetres.

Adams & Napier (2022) also gives a value for the fraction of remaining bodies as a function of time since capture:

$$f_{survived}(t) = \frac{1}{1 + (t/\tau)^{8/5}} \tag{4}$$

In Equation 4, $\tau = 0.84$ Myr; t is the time since the capture of the object. This value is derived from a fit to experimental data.

2.1 Lifetime of These Rocks

References

Adams, F. C. & Napier, K. J. (2022), 'Transfer of rocks between planetary systems: Panspermia revisited', *Astrobiology* **22**(12), 1429–1442.

Ginsburg, I., Lingam, M. & Loeb, A. (2018), 'Galactic panspermia', *The Astrophysical Journal Letters* **868**(1), L12.

Turekian, H. D. H. K. K. (2014), *Treatise on geochemistry*, 2 edn, Elsevier.