Planet Classes

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Telluric

Telluric := ⟨ m ∧ ρ ∧ g ∧ r ∧ v_e ⟩
m := ⟨0.02 ∧ 10.00⟩⊕
ρ := ⟨0.50 ∧ 7.00⟩⊕
g := ⟨0.15 ∧ 8.00⟩⊕
r := ⟨0.15 ∧ 3.00⟩⊕
v_e := ⟨0.25 ∧ 3.00⟩⊕

$$\text{TELLURIC} := \left\{ (m, \rho) \in \mathbb{R}^2 \;\middle|\; \begin{array}{l} 0.02 \leq m \leq 10.00 \\ 0.50 \leq \rho \leq 7.00 \\ 0.15 \leq g(m,\rho) \leq 8.00 \\ 0.15 \leq r(m,\rho) \leq 3.00 \\ 0.25 \leq v_e(m,\rho) \leq 3.00 \end{array} \right\}$$

> *Tellurics* are **parahabitable** worlds with solid or semi-solid surfaces — encompassing the full class of rocky, metallic, and icy planemos. This category includes Earthlike worlds, massive rocky exoplanets, marginal sub-Earths, and bodies like Mars, Ganymede, Titan, or large moons of gas giants. It defines the **geophysical domain of terrestrial planets** — whether habitable or not — and serves as the primary envelope from which Geotic, Gaean, and Rheatic worlds are derived.

Core Feature:

- This is a **broad categorization** — about 4.8% of Tellurics are Geotics, and only about 0.55% of all Tellurics are Gaeans — and 3.6% of Tellurics are Rheatics.
- These worlds possess **defined solid surfaces or lithospheres**, with no requirement for biological habitability.
- Many are **parahabitable** — survivable with life-support systems, domes, or partial terraforming.
- May include **frozen dwarfs**, **massive dry worlds**, or **oceania** with no dry land.
  Relations to Other Types:
- **Contains** all *Geotic*, *Gaean*, and *Rheatic* worlds.
- **Overlaps** with **Xenotic** worlds in the rocky mass range.
- Worlds like **Mars**, **Titan**, **Io**, and **Kepler-20b** are all Tellurics, despite wildly different surface conditions.
  Symbolic Use:
- The term draws from *Tellus*, the Latin Earth-mother, but in this context is **geostructural, not biological**.
- When contrasted with **Xenotic**, the distinction is about structure (rocky vs. exotic or gaseous), not life-hosting potential.

Geotic

Geotic := ⟨ m ∧ ρ ∧ g ∧ r ∧ v_e ⟩
m := ⟨0.30 ∧ 3.35⟩⊕
ρ := ⟨0.85 ∧ 1.25⟩⊕
g := ⟨0.60 ∧ 1.65⟩⊕
r := ⟨0.60 ∧ 1.50⟩⊕
v_e := ⟨0.65 ∧ 1.50⟩⊕

$$\mathrm{GEOTIC} := \left\{ (m,\rho) \in \mathbb{R}^2 \;\middle|\; \begin{array}{l} 0.30 \le m \le 3.35 \\ 0.85 \le \rho \le 1.25 \\ 0.60 \le g(m,\rho) \le 1.65 \\ 0.60 \le r(m,\rho) \le 1.50 \\ 0.65 \le v_e(m,\rho) \le 1.50 \end{array} \right\}$$

> *Geotics* are **habitable** planets — terrestrial-class worlds where humans can survive and thrive with minimal adaptation. These planets fall within a broader Earth-like envelope, allowing a wider range of environmental and structural conditions than Gaeans, while remaining physically and biologically viable for Earth-based life. Atmospheric processing, infrastructure, or selective location may be required, but **shirtsleeve environments** are still plausible.

Core Feature:

- *Density bounds* are kept narrow to ensure terrestrial composition (i.e., rocky–metallic silicate structure), but mass and radius are permitted greater variation, producing a range of surface gravities and escape velocities still compatible with Earth-based life — particularly plants, microbes, and well-supported human habitation.
  Implication:
- Geotics may include:
  - **Marginal Earth-twins** (on the edges of Gaean parameters)
  - **High-gravity super-Earths** (with greater landmass and thicker atmospheres)
  - **Cooler, lighter Earthlikes** (with lower pressure and gravity, but survivable biospheres)
  Geotic ≠ Gaean:
- All **Gaean** worlds are a *subset* of Geotics.
- But Geotics may include conditions beyond optimal comfort — requiring adaptation or technology to sustain human colonization.

Gaean

Gaean := ⟨ m ∧ ρ ∧ g ∧ r ∧ v_e ⟩
m := ⟨0.45 ∧ 1.85⟩⊕
ρ := ⟨0.85 ∧ 1.25⟩⊕
g := ⟨0.90 ∧ 1.10⟩⊕
r := ⟨0.70 ∧ 1.30⟩⊕
v_e := ⟨0.80 ∧ 1.20⟩⊕

$$\mathrm{GAEAN} := \left\{ (m,\rho) \in \mathbb{R}^2 \;\middle|\; \begin{array}{l} 0.45 \le m \le 1.85 \\ 0.85 \le \rho \le 1.25 \\ 0.90 \le g(m,\rho) \le 1.10 \\ 0.70 \le r(m,\rho) \le 1.30 \\ 0.80 \le v_e(m,\rho) \le 1.20 \end{array} \right\}$$

> *Gaeans* are **hospitable** planets — worlds whose surface environments require no special adaptation for unaided human life. They maintain **Earth-normal gravity** (⟨0.90 ∧ 1.10⟩⊕), and all other physical parameters — mass, radius, density, and escape velocity — fall within tightly Earthlike bounds. These planets support **shirtsleeve conditions**: humans can breathe the air, walk freely on the surface, and survive long-term without technological intervention.
> *All Gaeans are Geotics, but not all Geotics are Gaeans*.

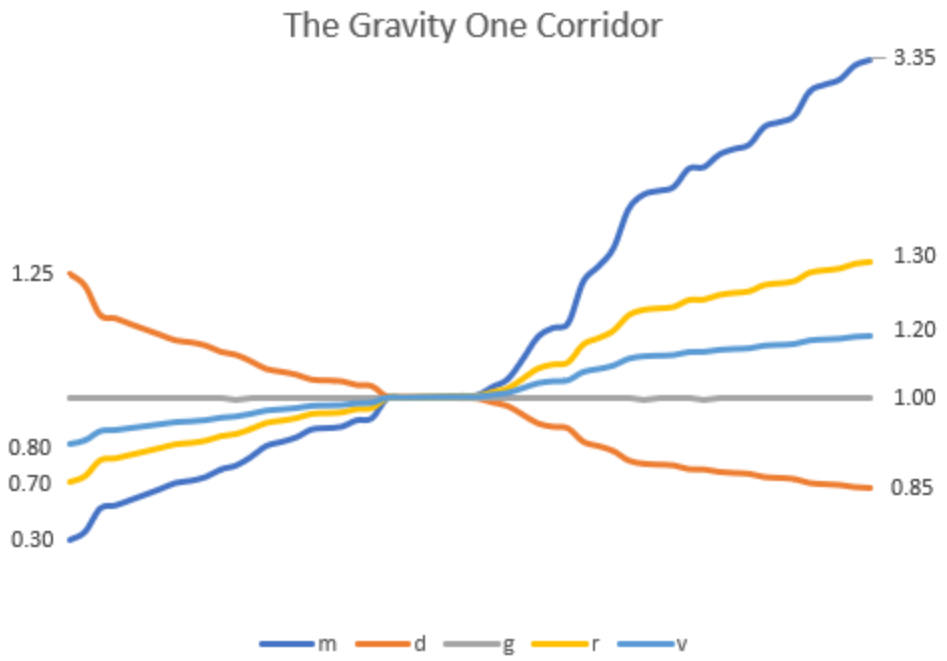
Gaean Worlds and the Gravity One Corridor

Gaean worlds are **hospitable** by definition — capable of supporting unmodified human life on the surface. But more than that, their defining feature is a surface gravity **within ±10% of Earth's**, or:

- 0.90 ≤ g ≤ 1.10 (in Earth gravities)

The Gravity One Corridor

This range centers on what we call the **Gravity One Corridor** — the precise locus of all planemo configurations (*mass–density pairs*) that yield **surface gravity = 1.000⊕**.



This narrow but critical pathway through parameter space defines the zone of optimal human comfort, physiology, architecture, and biomechanical function.

> When **g = 1.000⊕**, everything else — escape velocity, radius, and structural density — falls into predictable and manageable ranges.

As shown in the diagram:

- Planetary **mass (m)** and **density (ρ)** balance precisely to maintain **g = 1**.
- The resulting values for:
  - **Radius (r)** range from ~0.85⊕ to 1.25⊕

  - **Escape velocity (v_e)** from ~0.70⊕ to 1.30⊕
- This corridor provides an ideal baseline from which all other habitable world classes are derived.

Why This Matters

Approximately 17.7% of all Geotics fall **within or near** the Gravity One Corridor. Deviating too far from it — even if mass and radius are "in range" — results in a world that is:

- Less biomechanically comfortable
- More energetically expensive to escape
- More geostructurally unstable
- More challenging to terraform or sustain
  In short:

> **The closer a world hugs the Gravity One Corridor, the easier it is to call home.**

Rheatic

Rheatic := ⟨ m ∧ ρ ∧ g ∧ r ∧ v_e ⟩
m := ⟨1.00 ∧ 3.00⟩⊕
ρ := ⟨0.85 ∧ 1.25⟩⊕
g := ⟨0.85 ∧ 1.70⟩⊕
r := ⟨0.90 ∧ 1.50⟩⊕
v_e := ⟨0.95 ∧ 1.50⟩⊕

$$\text{RHEATIC} := \left\{ (m,\rho) \in \mathbb{R}^2 \;\middle|\; \begin{array}{l} 1.00 \le m \le 3.00 \\ 0.85 \le \rho \le 1.25 \\ 0.85 \le g(m,\rho) \le 1.70 \\ 0.90 \le r(m,\rho) \le 1.50 \\ 0.95 \le v_e(m,\rho) \le 1.50 \end{array} \right\}$$

> *Rheatics* are **parahabitable** planets — terrestrial super-Earths with conditions **favorable to rich biospheres** but likely **inhospitable to unmodified humans**. They may possess higher surface gravity, thicker atmospheres, and more energetic climates, often demanding mechanical, biological, or infrastructural adaptations for long-term Earthling presence. Nonetheless, they are considered **vivamaximal**: highly conducive to complex, robust life — just not necessarily Earthlike.

Overlap with Gaeans:

- A **small subset** of Rheatics — **≈13.9%** — fall within the Gaean gravity range (0.9 ≤ g ≤ 1.1⊕).
- These rare worlds are **massive and dense** enough to support Earth-normal surface conditions **while offering enhanced biospheric potential** — possibly the best of both worlds.
  Core Feature:
- The **“superhabitable” zone**: larger size means broader climatic bands, more plate tectonics, greater magnetic shielding, and longer tectonic–volcanic cycling — all of which may favor biospheric richness and diversity.
- **Human settlement** is plausible but typically **requires support**: enhanced structural design, medical mitigation of gravity effects, and climate regulation systems.

Distinction from Geotics:

- All Rheatics meet **Geotic** compositional constraints, but their **mass and gravity trends upward**.
- **Not all Geotics** are Rheatic: Rheatics are a **subset of high-mass, dense, habitable** planemos.
- Conversely, **not all Rheatics are Gaean** — only a small slice of them match that precise Earthlike window.

Xenotic

Xenotic := ⟨ m ∧ ρ ∧ g ∧ r ∧ v_e ⟩
m := ⟨0.0001 ∧ 4131⟩⊕
ρ := ⟨0.01 ∧ 7.00⟩⊕
g := ⟨0.02 ∧ 60.00⟩⊕
r := ⟨0.02 ∧ 11.00⟩⊕
v_e := ⟨0.02 ∧ 25.00⟩⊕

$$\text{XENOTIC} := \left\{ (m,\rho) \in \mathbb{R}^2 \;\middle|\; \begin{array}{l} 0.0001 \le m \le 4131 \\ 0.01 \le \rho \le 7.00 \\ 0.002 \le g(m,\rho) \le 60.00 \\ 0.02 \le r(m,\rho) \le 11.00 \\ 0.02 \le v_e(m,\rho) \le 25.00 \end{array} \right\}$$

> *Xenotics* are planemos whose environmental conditions may support **non-Earthlike life**, including **non-carbonic**, **non-water-based**, or otherwise exotic biochemistries. The term is not tied to physical parameters, but to the **biological strangeness** of the world's potential life-hosting capacity.

Core Feature:

- Xenotic classification **is not about what the world *is*** — it's about **what kind of life it might support**.
- A Xenotic world might be a rocky, icy, or gaseous body — but its **biotic potential lies outside** the realm of Earth-normal life.
- This is an *extremely* broad classification: only 0.35% of planemos sharing Xenotic mass and density ranges qualify as *Tellurics*. Gaeans share mass and density range with only 0.001% of Xenotics.
  Key Principle:

> A world may fall entirely within Gaean or Geotic **parameters** and still be **Xenotic in character** — if its biosphere is chemically or structurally **alien to terrestrial assumptions**.

Inclusions:

- **Ammonia-based** or **methanogenic** biospheres (e.g., Titan-like)
- **Silicon-based** or **plasma phase** consciousness (hypothetical)
- **High-pressure deep-atmosphere lifeforms** on gas giants
- **Ultra-dense crust-worlds** with lattice-bonded metabolic substrates
- **Life emerging in conditions unreplicable on Earth**
  Exclusions:
- Gaean or Geotic worlds are **not Xenotic** simply by shape or size.

- Xenotic worlds **may physically overlap** with all other categories — but their **life potential diverges completely**.
  Symbolic Use:
- From Greek *xenos* (ξένος): “stranger,” “foreigner,” “outsider.”
- Xenotic worlds are those where **life is not just different — it is alien**.
  Parameter Notes:
- **Mass (⊕):** from sublunar pebbles to brown dwarf threshold.
- **Density (⊕):** from hydrogen-ice slushes to ultra dense crystal-metallic cores.
- **Gravity (⊕):** ~0.02⊕ (Mars-like) up to ~60⊕ (felt at inner gas dwarf surfaces).
  - Spans everything from fragile ultralow-gravity cometary clumps to neutronium-crusted compact objects just short of degeneracy collapse.
  - This definition also accommodates highly stratified gas layers (e.g. floatable biospheres in Saturnian-class or puffy hot-Neptune exotics).
  - Any values beyond this envelope cross into **ulsic** or **hypotheticals**: black holes, quark matter, etc.
- **Radius (⊕):** up to 11⊕ to accommodate inflation-limited gas giants and Super-Jupiters.
  - Frequently exceeded by puffy planets due to close proximity to their stars inflating their atmospheres.
- **Escape Velocity (⊕):** capped at 25⊕ ≈ 280 km/s, brushing the domain of hot-start brown dwarfs.

> These are **not bound by Earth-normal biology**. They simply represent physically plausible, self-cohering planemo-scale entities where exotic life — as chemistry permits — might arise.