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Shell worlds

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Abstract

The traditional concept of terraforming assumes ready availability of candidate planets with acceptable qualities: orbiting a star in its “Goldilocks zone”, liquid water, enough mass, years longer than days, magnetic field, etc. But even stipulating affordable interstellar travel, we still might never find a good candidate elsewhere. Whatever we found likely would require centuries of heavy terraforming, just as Mars or Venus would here. Our increasing appreciation of the ubiquity of life suggests that any *terra nova* would already possess it. We would then face the dilemma of introducing alien life forms (us, our microbes) into another living world. Instead, we propose a novel method to create habitable environments for humanity by enclosing airless, sterile, otherwise useless planets, moons, and even large asteroids within engineered shells, which avoids the conundrum. These shells are subject to two opposing internal stresses: compression due to the primary’s gravity, and tension from atmospheric pressure contained inside. By careful design, these two cancel each other resulting in zero net shell stress. Beneath the shell an Earth-like environment could be created similar in almost all respects to that of Home, except for gravity, regardless of the distance to the sun or

other star. Englobing a small planet, moon, or even a dwarf planet like Ceres, would require astronomical amounts of material (quadrillions of tons) and energy, plus a great deal of time. It would be a quantum leap in difficulty over building Dyson Dots or industrializing our solar system, perhaps comparable to a mission across interstellar space with a living crew within their lifetime. But when accomplished, these constructs would be complete (albeit small) worlds, not merely large habitats. They could be stable across historic timescales, possibly geologic. Each would contain a full, self-sustaining ecology, which might evolve in curious directions over time. This has interesting implications for SETI as well.

Highlights

- ° Moons, dwarf planets, and large asteroids can be enclosed in engineered shells.
- ° Internal air pressure cancels gravity's compression; net shell stress is zero.
- ° Artificial light needed; low-gravity but otherwise Earth-like environment inside.
- ° Sidesteps moral hazard of settling rare extrasolar worlds w/aliens (us).
- ° It can be built around any star's interesting implications for SETI.



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Keywords

Megastructures; Space colonization's industrialization; Circumstellar habitable zones; Terraforming; Extraterrestrial resources; SETI

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