THE IMPORTANCE OF SELF-TUNED WAVE GUIDES IN FLUID HABITATS FOR LIFE. Robert H. Tyler[1,2], (1) Geodesy and Geophysics Laboratory, Code 61A NASA Goddard Space Flight Center; Greenbelt, MD 20771; Email: robert.h.tyler@nasa.gov; Tel: 301-614-6472; (2) Department of Astronomy, University of Maryland at College Park.

Resonant excitation of fluid wave guides will arrive in predictable situations where there is a match in form and frequency between available forces and the fluid's eigenmodes of oscillation. The resonant response is typically orders of magnitude more energetic than in non-resonant configurations involving only slight differences in parameters, and the behavior can be quite different because different oscillation modes are favored in each. This study shows that self-tuned wave guides can form in fluids, with an important consequence of greatly raising the efficiency in which a system's spin/orbit energy is tidally transferred to the fluid. The study also suggests that such resonantly forced, energetic scenarios may be more common than exotic because these scenarios appear as stable "attractors" in the space of potential scenarios.

The resonances are easily identified in solutions by the associated peaks in the power. But because these peaks may be both very many and relatively narrow, calculation of millions of solutions can be required to complete the description of the solution's dependence over the range of parameter values. (Construction of these large solution spaces is performed using a fast, semi-analytical method that solves the forced, dissipative, Laplace Tidal Equations subject to the constraint of dynamical consistency (through a separation constant) with solutions describing the vertical structure.)

Filling in the solution space in this way is used not only to locate the parameter coordinates of resonant scenarios but also to study allowed migration paths through this space. It is suggested that resonant scenarios do not arrive through happenstance but rather because secular variations in parameters make the configuration migrate into one of many resonant scenarios, with associated feedbacks either accelerating or halting the configuration migration. Where the effect of increased energy due to approaching resonance acts as a negative feedback on the migration parameters, the scenario is stabilized in a state near resonance.

Most directly, these resonant scenarios describe elevated work raising the wave energy of the system. But the low-entropy wave energy is ultimately transferred to high-entropy heat and other dissipative energy forms. This provides then a collection of energy considerations important to habitats of life.