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Rotating space elevators: Nonlinear dynamics of celestial scale spinning strings STEVEN KNUDSEN, LEONARDO GOLUBOVIC, West Virginia University — We explore classical and statistical mechanics of a novel dynamical system, the Rotating Space Elevator (RSE). The RSE is a *double* rotating floppy string reaching extraterrestrial locations. Objects sliding along the RSE string (climbers) do *not* require internal engines or propulsion to be transported far away from the Earth's surface. The RSE thus solves a major problem in space elevator science which is how to supply energy to the climbers moving along space elevator strings. The RSE can be made in various shapes that are stabilized by an approximate equilibrium between the gravitational and inertial forces acting in a double rotating frame associated with the RSE. This dynamical equilibrium is achieved by a special ("magical") form of the RSE mass line density. The RSE exhibits a variety of interesting dynamical phenomena. Thanks to its special design, the RSE exhibits everlasting double rotating motion. Under some conditions however, we find that the RSE may undergo a morphological transition to a chaotic state reminiscent of fluctuating directed polymers in the realm of the statistical physics of strings and membranes.

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