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Profiles of cosmic strings for a gauged B-L symmetry

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In the Standard Model, the difference between the baryon number B and the lepton number L is conserved, which implies an exact, global symmetry.
We turn it into a naturally exact, local symmetry by coupling the quantum number B-L to an Abelian gauge field.
Gauge anomalies are cancelled by adding right-handed neutrinos nu_R, which are not sterile. We arrange for a nu_R-mass by adding a Higgs-type 1-component complex scalar field. Thus we arrive at a modest but well-motivated Standard Model extension.

We investigate the field equations in the corresponding extended gauge-Higgs sector, involving both Higgs fields and the non-standard U(1) gauge field. This leads to a set of coupled, non-linear differential equations, which we solve numerically, focusing on the structures of cosmic strings. For a variety of parameters, we identify the string profiles and energy densities.
These profiles depend on the winding number of each of the Higgs fields. As amazing peculiarities, we discover - for high winding numbers - “overshooting” and “co-axial” solutions; in the latter case, the profile of the standard Higgs field changes its sign near the core of the cosmic string.

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