

# New Windows on Fundamental Physics: from tabletop devices to large scale detectors



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Type: **Talk (UK-APP one-day meeting)**

## Matter Sourced Bubble Nucleation in the Asymmetron Scalar-Tensor Theory

*Monday, 19 January 2026 15:00 (30 minutes)*

We investigate how matter density distributions affect thin-wall bubble formation in the asymmetron mechanism, a scalar–tensor theory with a universal coupling to matter and explicit symmetry-breaking, and analyse the stability of its metastable state. We show that the screening mechanism of the asymmetron inside dense objects induces a surface tension associated with the boundary of the screening object, leading to a richer class of bubble solutions than the standard Coleman–Callan bulk nucleation. These boundary surface tensions are used to modify the Nambu-Goto action for instantons, allowing for the computation of the corresponding Euclidean action for bubbles nucleating on flat planes, as well as on concave and convex cylindrical surfaces. We find that the smallest Euclidean action occurs for bubbles nucleating along the edge of a concave spherical surface. Comparing this edge nucleation channel with the bulk one, we determine the maximum curvature radius for which concave edge nucleation is preferred. Since the maximum radius of curvature is exponentially suppressed by the action of a bulk bubble, we find that within the regime of the instanton approximation, edge nucleation is always preferred. This is largely due to the weak couplings of the asymmetron. We apply these findings to determine the maximum curvature radius of a cosmic void and discuss how our results affect the seeding of  $N$ -body simulations of asymmetron domains, showing that domain wall nucleation preferentially occurs at the edges of cosmological voids. We also demonstrate that the presence of a homogeneous gas around the dense substrates reduces the maximum curvature radius, enabling bulk bubbles to form preferentially as the asymmetron undergoes a density-driven phase transition.

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