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Nonsingular gravitational collapse and implications for exotic compact objects

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The description of General Relativity is expected to break down in processes of gravitational collapse and in the very early universe, when the energy density is absurdly large and geodesic completeness fails to be satisfied. Extensions of this standard model have been proposed to address that issue, typically finding bouncing cosmological scenarios and regular black holes with de Sitter cores. Though many examples of bouncing cosmologies exist, the dynamical formation of de Sitter cores has not been observed yet. I will present a modified gravity scenario in which the process of collapse of a boson star is analysed using advanced numerical relativity methods. From the outside, the outcome is a typical hairy black hole but from the inside it looks like a bouncing cosmology, containing a minimal area surface that sets the beginning of a baby universe. This result suggests that new forms of exotic compact objects, which we call wormhole mimickers, could exist in Nature. I will also comment on their observational characterization.