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Twist-free axisymetric critical collapse of a complex scalar field

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It has been thirty years since the breakthrough paper of M. Choptuik on critical phenomena in the gravitational collapse of a real massless scalar field in spherical symmetry. This celebrated paper led to a rich exploration of different extreme spacetimes in numerical relativity, which persistently question the weak cosmic censorship conjecture, contribute to our understanding of spacetime singularities, as well as construct new avenues for the mathematical relativity community.

One would naively expect that the phenomena witnessed by Choptuik would generalize to full 3+1 dimensions. However, recent research has indicated that the standard picture of critical phenomena in gravitational collapse changes once symmetry is dropped, for instance, in the case of vacuum collapse of gravitational waves. In our work, we examine the gravitational collapse of a massless complex scalar field minimally coupled to GR, for the first time using a pseudospectral code (bamps), in spherical symmetry and beyond. We report deviations from Choptuik's solution and show evidence aiming to bridge our understanding of Choptuik's threshold and the vacuum threshold of collapse.

In this talk, I am going to highlight the main results of our recently published paper: https://doi.org/10.1103/PhysRevD.109.124042

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