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Curvature singularities in $f(R)$ modified gravity

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Even though $f(R)$ modifications of late time cosmology is very successful in explaining the cosmic acceleration, it is very difficult to simultaneously satisfy the fifth-force constraint. Even in this case, the effective scalar degree of freedom may move to a point (close to its minima) in the field space where the Ricci scalar diverges. We elucidate this point further with a specific example of $f(R)$ gravity that incorporates all viable $f(R)$ gravity models in the literature. In particular, we show that the nonlinear evolution of the field in pressureless contracting dust can easily lead to the curvature singularity, making these theories nonviable.

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