## Sixteenth Marcel Grossmann Meeting



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## Infinitely degenerate exact Ricci-flat solutions in $f(R)\ {\rm gravity}$

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The evidence is mounting that the Universe is currently undergoing a phase of accelerated expansion. One possible alternative is the modification in gravity in the largest possible scales. This leads to the many questions related to black-holes: violation of Birkhoff theorem and no-hair theorem. To confirm/infirm, we need to obtain exact black-hole solutions in these modified gravity theories.

In this talk, we focus on the exact spherically symmetric solutions in f(R) theories of gravity. We explicitly show that some f(R) models contain an infinite number of exact static, Ricci-flat spherically symmetric vacuum solutions and, hence, violate Birkhoff's theorem in f(R) theories. We analytically derive two exact vacuum black-hole solutions for the same class of f(R) theories. The two black-hole solutions have the event-horizon at the same point; however, their asymptotic features are different. Our results suggest that the no-hair theorem may not hold for generic modified gravity theories. We discuss the implications of our work to distinguish modified gravity theories from general relativity. (Based on arXiv:2003.05139)

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