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What if black hole spacetimes are singularity-free?

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Although the Penrose-Hawking singularity theorems leave little room for the fate of collapsing matter, since the 1960s there has been great interest in the possibility of deriving black hole solutions with a regular center. In this talk, after a brief historical review, I will discuss the main features of regular black holes and their implications for fundamental physics. Finally, I will comment on the emerging new phenomenology in astrophysics and particle physics and what can be learned from such spacetimes for the future.

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