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## Lessons from the geometric structure of black holes

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Black holes are an extremely fruitful playground for theoretical physicists, allowing one to address complex questions about the nature of reality, such as the information paradox, quantum entanglement, and even the use of black holes as a proxy for a quantum field theory in flat space. Here we discuss what we can learn solely from the mathematical structure of certain black holes in a negatively curved spacetime. We will see that we can determine the quasinormal modes of these spacetimes, thereby translating the classic question “Can you hear the shape of a drum?” to “Can you hear the shape of spacetime?” We will discuss applications to warped black hole geometries as well as Kerr black holes (those black holes observed by the Event Horizon Telescope).

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