Title: **Are black holes really that simple?**

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Summary:

Black holes seem to be fascinatingly simple - in contrast to other compact objects without event horizon such as neutron stars. Recent gravitational wave observations from the collision of two (supposed) black holes have demonstrated that these events only produced gravitational and no other radiation, while a also detected neutron star collision was matched to an accompanying gamma-ray burst. These observational results agree with the theoretical prediction that black holes can be described by a very small number of conserved quantities - mass, charge and angular momentum. However, models appearing in theories that try to explain e.g. the nature of dark energy or the inflationary epoch in the primordial universe as well as recent studies in applications of the gauge/gravity duality contain black hole solutions that often carry so-called "hair", i.e. non-trivial fields on the event horizon. I will give a review on the current status of the so-called "No hair conjecture" and also mention recent studies and applications of black holes that carry additional structure.