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Hidden symmetry, soft hair and Love numbers beyond Kerr

Hidden conformal symmetry (HCS) is the backbone of the proposed Kerr/CFT correspondence away from extremality. Recently this topic has gained a new lease on life, for three reasons: 1) the connection with the soft hair program, in which HCS acts non-trivially on the black hole horizon to generate soft hair, 2) the discovery of a set of globally defined HCS generators with a link to tidal Love numbers, and 3) the relationship between HCS and the hidden symmetries generated by Killing-Yano tensors responsible for the separability of equations of motion. Here we present results of forthcoming work which elucidate the physical meaning behind the choice of the standard HCS generators versus the Love symmetry generators. As these Love generators have a smooth Schwarzschild limit, we use them to study a class of slowly-rotating black holes that admit exact Killing symmetries, thereby strengthening the connection between HCS, the Killing tensors of separability, and Love numbers. As an intriguing contrast, we discuss hidden symmetries in the context of a non-separable black hole background: the dipole and doubly-spinning black ring.

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