

Erratum to, and some new information concerning the paper

“No Hair” Theorems – Folklore, Conjectures, Results  
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on page 2 the definition of a Killing horizon should be replaced by the following:

Let  $N[X]$  be the set of points on which  $X$  is *null* and *non-vanishing*. Let  $\mathcal{N}[X]_a$  be any connected component thereof which *is a null hypersurface*. Any union  $\mathcal{N}[X] = \cup_{a \in \mathcal{A}} \mathcal{N}[X]_a$  of such sets  $\mathcal{N}[X]_a$ , where  $\mathcal{A}$  is some non-empty index set (perhaps, but not necessarily, consisting of one element only), will be called a *Killing horizon*.

I am grateful to Ted Jacobson for pointing out this omission to me.

In some of the claims about uniqueness of black holes the condition of connectedness of the black hole should be added. The point is, that while this condition is not needed in the Bunting – Massood-ul-Allam proof, the condition is needed in the electrovac case (but not in vacuum) in the Sudarsky–Wald proof of staticity (unless some extra conditions have been assumed).

This is also to point out that with Bobby Beig we have recently settled in the positive Conjecture 1.8 of the above paper, and settled in the positive Conjecture 3.2 under the supplementary hypothesis that  $\dim G > 1$ . [This is actually another omission in the review paper; when writing this Conjecture 3.2 the author certainly had in mind the hypothesis  $\dim G > 1$  (and it is perhaps more or less clear from the context that this was his intention); but this condition has inadvertently been omitted in the statement of Conjecture 3.2. With the condition  $\dim G > 1$  the proof of that Conjecture is a relatively straightforward study of isometry groups in asymptotically flat space-times. The proof of Conjecture 3.2, as it stands in the above paper, would require the proof of the existence of a second Killing vector, which is of course an issue of completely different nature.]

Finally, in recent work with R. Wald we have been able to show that the domain of outer communication of a black hole satisfying field equations with the null energy condition (energy-momentum tensor non-negative when contracted on both indices with any null vector) has to be simply connected,

each connected component of the black hole being a sphere. This gets rid of the possible toroidal topology, which wasn't taken care of properly in the proofs of the results claimed by Hawking.

The above new results are being prepared for publication now, but no preprints are available yet.

I wish also to point out that new results of Wald and Rácz (in preparation) seem to suggest that the condition of existence of a bifurcation surface for non-degenerate horizons lying on the boundary of the domain of outer communication can be gotten rid of in a satisfactory way.