AXISYMMETRIC ASYMPTOTICALLY FLAT RADIATIVE SPACE-TIMES WITH ANOTHER SYMMETRY: THE GENERAL DEFINITION AND COMMENTS

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The title of my talk at the conference referred directly to the *boost-rotation symmetry*. The title above is, in fact, a "synonym":

THEOREM *Suppose that an axially symmetric vacuum space-time is asymptotically flat in the sense that it admits local smooth null infinity, i.e., suppose that the Bondi coordinates can be introduced and that the metric is asymptotically of standard Bondi's form* [1] *for* $\phi \in [0, 2\pi)$ *and some open interval* θ. *Suppose that this space-time admits an additional Killing vector which forms a 2-dimensional Lie algebra with the axial Killing vector. Assume that this additional symmetry allows gravitational radiation (i.e. Bondi's news function is non-vanishing). Then the additional symmetry has to be the boost symmetry and the additional Killing vector is the boost Killing vector.*

Roughly speaking, in axially symmetric asymptotically flat space-times, the only second allowable symmetry that does not exclude radiation is the boost symmetry. In the proof of the theorem (which we gave with B.G. Schmidt in [2] but which has a longer history — see references in [2]), it was assumed that the rotational Killing vector is hypersurface orthogonal. Recently, together with R. Muschall [3], we generalized the theorem to the case of the rotational Killing field which need not be hypersurface orthogonal. Moreover, although no rigorous proof is available so far, it appears that all other radiative space-times with two symmetries are not asymptotically flat (see the discussion of the 2-dimensional group of null rotations and some further remarks in [2]). In this sense, the boost-rotation symmetric space-times would play a unique role among asymptotically flat-radiative space-times. An infinite number of various boost-rotation symmetric space-times can be constructed *explicitly*, which, very probably, will not be feasible in the (much more realistic) case of space-times with one symmetry only.

The boost-rotation symmetric solutions represent the fields of "uniformly accelerated sources" in general relativity. At present only explicit vacuum solutions describing accelerated singularities (of the Curzon-Chazy-Scott type, and of all the other Weyl