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On the representation theory of the BMS group and its variants in three space-time dimensions

The original Bondi–Metzner–Sachs (BMS) group B is the common asymptotic symmetry group of all asymptotically flat Lorentzian radiating 4-dim space–times. As such, B is the best candidate for the universal symmetry group of General Relativity (G.R.). In 1973, with this motivation, McCarthy classified all relativistic B-invariant systems in terms of strongly continuous irreducible unitary representations (IRS) of B. Here we introduce the analogue B(2, 1) of the BMS group B in 3 space–time dimensions. B(2, 1) itself admits thirty-four analogues both real in all signatures and in complex space–times. In order to find the IRS of both B(2, 1) and its analogues, we need to extend Wigner–Mackey's theory of induced representations. The necessary extension is described and is reduced to the solution of three problems. These problems are solved in the case where B(2, 1) and its analogues are equipped with the Hilbert topology. The extended theory is necessary in order to construct the IRS of both B and its analogues in any number d of space–time dimensions, d≥3, and also in order to construct the IRS of their supersymmetric counterparts. We use the extended theory to obtain the necessary data in order to construct the IRS of B(2, 1). Themainresultsoftherepresentationtheoryareas-follows:TheIRSareinducedfrom "little groups"which are compact. The finite "little groups"are cyclic groups of even order. The inducing construction is exhaustive notwithstanding the fact that B(2, 1) is not locally compact in the employed Hilbert topology.

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