Poisson twisted kappa-(Anti) de Sitter algebras in (3+1) dimensions

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We present the generalisation to (3+1) dimensions of a quantum deformation of the (2+1) (Anti)-de Sitter and Poincaré Lie algebras that is compatible with the conditions imposed by the Chern–Simons formulation of (2+1) gravity. In particular, a canonical classical r-matrix arising from a Drinfel'd double structure for the three (3+1) Lorentzian algebras is obtained. This r-matrix turns out to be a twisted version of the one corresponding to the (3+1) κ-deformation, and the main properties of its associated noncommutative spacetime are analysed. Furthermore, it is shown that this new quantum spacetime is not isomorphic to the κ-Minkowski one, and that the isotropy of the quantum space coordinates can be preserved through a suitable change of basis of the quantum algebra generators. Next, the quantum duality principle is used to construct explicitly the Poisson analogue of such twisted $(3+1)$ κ-(Anti)-de Sitter quantum algebras obtaining their corresponding Poisson–Lie structure on the dual Lie group. The cosmological constant Λ is included as a Poisson–Lie group contraction parameter, and the limit $\Lambda \to 0$ leads to the well known twisted κ-Poincaré algebra in the bicrossproduct basis.