

Extending Structures II: The Quantum Version

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Let A be a Hopf algebra and H a coalgebra. We shall describe and classify up to an isomorphism all Hopf algebras E that factorize through A and H : that is E is a Hopf algebra such that A is a Hopf subalgebra of E , H is a subcoalgebra in E with $1_{\{E\}} \in H$ and the multiplication map $A \otimes H \rightarrow E$ is bijective. The tool we use is a new product, we call it the unified product, in the construction of which A and H are connected by three coalgebra maps: two actions and a generalized cocycle. Both the crossed product of a Hopf algebra acting on an algebra and the bicrossed product of two Hopf algebras are special cases of the unified product. A Hopf algebra E factorizes through A and H if and only if E is isomorphic to a unified product of A and H . All such Hopf algebras E are classified up to an isomorphism that stabilizes A and H by a Schreier type classification theorem. A coalgebra version of lazy 1-cocycles as defined by Bichon and Kassel plays the key role in the classification theorem.

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