



Venerdì 30 Settembre 2016, ore 14:30, **Sala Wataghin**

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Pentaquark structures

We study the possibility that at least one of the two pentaquark structures recently reported by LHCb could be described as a compact pentaquark state and we give predictions for new channels that can be studied by the experimentalists if this hypothesis is correct. We use very general arguments, dictated by symmetry considerations, in order to describe the pentaquark states within a group theory approach. A complete classification of all possible states and quantum numbers, which can be useful both to the experimentalists in their search for new findings and to theoretical model builders, is given, without the introduction of any particular dynamical model. Some predictions are finally given using a simple Guersy and Radicati inspired mass formula, that breaks the SU(4) symmetry. We reproduce the mass and the quantum numbers of the lightest pentaquark state reported by LHCb (the $J^P = 3/2^-$ state), with a parameter-free mass formula, fixed on the well-established baryons. We predict other pentaquark resonances (giving their masses, and suggesting possible decay channels) which belong to the same multiplet as the lightest one.