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Flavor Symmetries and Winding Modes

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Modular flavor symmetries have been proposed as a new way to address the flavor problem. It is known that they can emerge from string compactifications. We discuss this connection in detail, and show how the congruence subgroups of SL(2,Z), which underlie many modular flavor symmetries, emerge from stringy duality symmetries by orbifolding. This requires an analysis of massive states, which reveals a picture that is more intricate than the well-known situation on the torus. It involves towers of states of different quantum numbers, related by modular transformations. Members of different towers become massless at different points in moduli space. We also show that, at least in the Z3 orbifold, the string selection rules can be understood as discrete remnants of continuous gauge symmetries. Non-Abelian discrete flavor symmetries arise as discrete remnants of various, relatively misaligned, continuous Abelian gauge symmetries. The generators of these U(1)symmetries give rise to CP-violating Clebsch–Gordan coefficients. If the modulus settles close to a critical point, the corresponding gauge bosons may be light enough to be searched for at future colliders.

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