High Energy Physics - Theory

The overarching finite symmetry group of Kummer surfaces in the Mathieu group M_24

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In view of a potential interpretation of the role of the Mathieu group M_24 in the context of strings compactified on K3 surfaces, we develop techniques to combine groups of symmetries from different K3 surfaces to larger 'overarching' symmetry groups.
We construct a bijection between the full integral homology lattice of K3 and the Niemeier lattice of type (A_1)^24, which is simultaneously compatible with the finite symplectic automorphism groups of several different Kummer surfaces. The Niemeier lattice serves to express all these symplectic automorphisms as elements of the Mathieu group M_24, generating the 'overarching finite symmetry group' (Z_2)^4:A_7 of Kummer surfaces. This group has order 40320, thus surpassing the size of the largest finite symplectic automorphism group of a K3 surface by orders of magnitude, and it contains the polarization-preserving symmetry group of every Kummer surface with polarization induced from the underlying torus. Our results are in line with the existence proofs of Mukai and Kondo, that finite groups of symplectic automorphisms of K3 are subgroups of one of eleven subgroups of M_23, and we extend their techniques of lattice embeddings for all Kummer surfaces with polarization induced from the underlying torus.

Comments:	64 pages, 1 figure; Reference to Nikulin's theorem (our theorem 2.1.3) corrected; accordingly, minor adjustments in proofs of theorems 2.3.3. and 3.3.7
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