

The cyclic symmetries in the representations of unitary discrete subgroups

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Dark matter may be stable because of a conserved Z_p (cyclic) symmetry. Usually p is assumed to be 2, but it may also be larger than 2.

This Z_p is usually assumed to be in a direct product with some other symmetry group. The full symmetry group of the theory is then $G = Z_p \times G'$. We suggest another possibility.

Many discrete subgroups of $U(n)$, for any $n > 2$, have a non-trivial center Z_p , even if they are not the direct product of that Z_p with some other group. When that happens, the irreducible representations (irreps) of the group may either represent all the elements of that Z_p by the unit matrix, or else they may represent that Z_p faithfully. If ordinary matter is placed in a representation where Z_p is represented by 1, and dark matter is placed in irreps that represent Z_p faithfully, then dark matter is stabilized by that Z_p .

We have scanned all the discrete groups in the SmallGroups library with order < 2000 that are not the direct product of a cyclic group with some other group. We have determined their centers and whether they are subgroups of one or more groups $SU(n)$ or $U(n)$. We have found that very many groups, especially subgroups of $U(n)$ but not of $SU(n)$, have non-trivial centers Z_p , mostly with p of the form $2^a \times 3^b$ but also with other values of p .

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