Calogero-type models with maximally extended superconformal symmetry

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Abstract:

We overcome the barrier of constructing $N=4$ superconformal models in one space dimension for more than three particles. The $D(2,1;\alpha)$ superalgebra of our systems is realized on the coordinates and momenta of the particles, their superpartners and one complex pair of harmonic variables. The models are determined by two prepotentials, F and U, which must obey the WDVV and a Killing-type equation plus homogeneity conditions. We investigate permutation-symmetric solutions, with and without translation invariance. Models based on deformed A_n and BCD_n root systems are constructed for any value of alpha, and exceptional F_n-type and super root systems admit solutions as well. Translation-invariant mechanics occurs for any number of particles at $\alpha = -1/2$ ($osp(4|2)$ invariance as a degenerate limit) and for four particles at arbitrary alpha (three series).