

On some special solutions to periodic Benjamin-Ono equation with discrete Laplacian

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We investigate a periodic version of the Benjamin-Ono (BO) equation associated with a discrete Laplacian. We find some special solutions to this equation, and calculate the values of the first two integrals of motion I_1 and I_2 corresponding to these solutions. It is found that there exists a strong resemblance between them and the spectra for the Macdonald q -difference operators. To better understand the connection between these classical and quantum integrable systems, we consider the special degenerate case corresponding to $q=0$ in more detail. Namely, we give general solutions to this degenerate periodic BO, obtain explicit formulas representing all the integrals of motions I_n ($n=1,2,\dots$), and successfully identify it with the eigenvalues of Macdonald operators in the limit $q \rightarrow 0$, i.e. the limit where Macdonald polynomials tend to the Hall-Littlewood polynomials.

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