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Hyperdeterminants as integrable 3D difference equations

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Abstract

In this talk, **co-authored with Sergey Tsarev**, we give the basic definitions and known theoretical results about hyperdeterminants, briefly sketch their modern applications (quantum computing, biomathematics, numerics, stochastic calculus etc.) and give a proof of integrability (understood as 4d-consistency) of a difference equation defined by the $2 \times 2 \times 2$ hyperdeterminant. Independently integrability of the $2 \times 2 \times 2$ hyperdeterminant was stated by R. Kashaev (1996) and W. Schief (2003).

A natural conjecture is that all 2^n hyperdeterminants define discrete integrable equations.

We prove that this conjecture already fails in the case of the $2 \times 2 \times 2$ hyperdeterminant, computed recently by B. Sturmfels *et. al* (www.arxiv.org, [math.CO/0602149](https://arxiv.org/abs/math/0602149) v2 3 Oct 2006).