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Two ways to generalize matroids with coefficients

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Dress (1986) introduced matroids with coefficients offering a unified approach to ordinary matroids, representations of matroids over fields, and oriented matroids. Baker and Bowler (2019) extended this theory, whose result includes a partial field representation by Semple and Whittle (1996).

I will present two generalizations of matroids with coefficients. One is about skew-symmetric matrices and even delta-matroids, based on joint work with Tong Jin. We deduce several results on the representability of even delta-matroids as applications. The other concerns symmetric matrices and new matroid-like objects called antisymmetric matroids. It extends old results on the representability of matroids by Tutte (1958) and basis graphs of matroids by Maurer (1973). These two generalizations involve an interesting interplay between Lagrangian orthogonal/symplectic Grassmannians and combinatorics.

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