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Generalized Green's Theorem

Green proved Green's Theorem on how the Hilbert function changes after taking a quotient by a generic linear form. He used this result to provide a new and simple proof of Macaulay's Theorem, which characterizes the Hilbert functions of graded ideals in a polynomial ring. Herzog and Popescu extended Green's result to generic forms of any degree, but under the assumption that the ground field has characteristic zero. Later, Gasharov found a new proof that works in all characteristics. We provide a different proof, which works in all characteristics and which works not only over polynomial rings but also yields the new result that the theorem holds over Clements–Lindstrom quotient rings.

This is joint work with Jeff Mermin.