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Real and complex line fields on manifolds

Thursday, 18 September 2025 14:30 (1 hour)

In this talk, I will explore algebraic invariants that govern certain geometric properties of manifolds. The prototypical example is Hopf's theorem, which states that a smooth manifold admits a non-vanishing vector field if and only if the Euler characteristic vanishes. To begin, I will define and motivate the projective span of a smooth manifold, which is the maximal number of pointwise linearly independent line fields. The determination of the projective span of a given smooth manifold (or family of manifolds) is referred to as the line field problem. Along the way, I will mention joint work with Mark Grant [Bol. Soc. Mat. Mex. 30(3):75, 2024] in which we solve the line field problem for all of the Wall manifolds. Chiefly, from work joint with Nikola Sadovek [arXiv:2411.14161], I will identify complete obstructions to the existence of 1, 2, or 3 linearly independent line fields on certain classes of almost-complex manifolds, thereby improving the tractability of the solving the line field problem for such manifolds. Finally, I will comment on an application of these results to complex geometry.

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