**Geometric Foundations of Gravity 2025** 



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## Well-posed evolution and gravitational collapse of self-interacting vector fields

Dynamical evolution of self-interacting vector fields often faces instabilities and apparent pathologies when performing numerical simulations. By displaying a detailed analysis of the initial-value problem of the theory in the language of scalar-tensor theories, I will show that the former are actually due to the breakdown of the hyperbolicity of the theory (Tricomi-type or Keldysh-type). I will also give numerical evidences that these issues can be avoided by means of the "fixing-the-equations" approach, enabling stable numerical evolutions in spherical symmetry. Finally, I will report on initial configurations for the massive vector field leading to gravitational collapse and the formation of black holes, for a particular class of self-interactions in which no "pathologies" take place.

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