## Title:

Numerical methods for compressible multiphase flows with curl involutions **Authors:** 

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## Abstract:

This talk explores advanced numerical methods for solving compressible barotropic two-phase flows modeled using the conservative Symmetric Hyperbolic Thermodynamically Compatible (SHTC) model proposed by Romenski et al. in [1, 2]. The original model in multidimensional cases is weakly hyperbolic, but the strong hyperbolicity can be restored by using techniques such as the explicit symmetrization of the system, adding terms that contain linear combinations of the curl involution or the hyperbolic Generalized Lagrangian Multiplier (GLM) curl-cleaning approach. The resulting hyperbolic PDE system is solved using a high-order ADER discontinuous Galerkin method with a posteriori sub-cell finite volume limiter to deal with shock waves and steep gradients in the volume fraction, [3], and considering an exactly curl-free finite volume scheme to handle the curl involution in the relative velocity field, [4]. Several test cases will be presented in one and two spatial dimensions, as to provide evidence of the approach's validity.

## References

- Romenski, E., Resnyansky, A., Toro, E.: Conservative hyperbolic formulation for compressible two-phase flow with different phase pressures and temperatures. Quart. Appl. Math. 65(2), 259–279, 2007.
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- [3] Río-Martín, L., Dumbser, M.: High-order ADER Discontinuous Galerkin schemes for a symmetric hyperbolic model of compressible barotropic twofluid flows, Commun. Appl. Math. Comput, 6, 2119–2154, 2024.
- [4] Río-Martín, L., Dhaouadi, F., Dumbser, M. An Exactly Curl-Free Finite-Volume/Finite-Difference Scheme for a Hyperbolic Compressible Isentropic Two-Phase Model. J Sci Comput 102, 13, 2025.

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