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	authors: • Elias R. Most • Jorge Noronha • Alexander A. Philippov **title**: Modeling general-relativistic plasmas with collisionless moments and dissipative two-fluid magnetohydrodynamics **publication_date**: 2022-07-02 00:00:00 **source**: SupportedSources.INTERNET_ARCHIVE **journal**: **volume**: **doi**: **urls**: • https://web.archive.org/web/20220707214404/https://arxiv.org/pdf/2111.05752v2.pdf **id**: id-6630039219445032346 **abstract**: Relativistic plasmas are central to the study of black hole accretion, jet physics, neutron star mergers, and compact object magnetospheres. Despite the need to accurately capture the dynamics of these plasmas and the implications for relativistic transients, their fluid modeling is typically done using a number of (overly) simplifying assumptions, which do not hold in general. This is especially true when the mean free path in the plasma is large compared to the system size, and kinetic effects start to become important. Going beyond common approaches used in the literature, we describe a fully relativistic covariant 14-moment based two-fluid system appropriate for the study of electron-ion or electron-positron plasmas. This generalized Israel-Stewart-like system of equations of motion is obtained directly from the relativistic Boltzmann-Vlasov equation. Crucially, this new formulation can account for non-ideal effects, such as anisotropic pressures and heat fluxes. We show that a relativistic two-fluid plasma can be recast as a single fluid coupled to electromagnetic fields with (potentially large) out-of-equilibrium corrections. In particular, we keep all electron degrees of freedom, which provide self-consistent evolution equations for electron temperature and momentum. The equations outlined in this paper are able to capture the full two-fluid character of collisionless plasmas found in black hole accretion and flaring processes around compact objects, as well Braginskii-like two-fluid magnetohydrodynamics applicable to weakly collisional plasmas inside accretion disks. This new formulation will be instrumental in the construction of a large class of next-generation simulations of relativistic transient phenomena produced around black holes and neutron stars. **versions**:	**authors**: • E. Most • J. Noronha • A. Philippov **title**: Modeling general-relativistic plasmas with collisionless moments and dissipative two-fluid magnetohydrodynamics **publication_date**: 2021-11-10 00:00:00 **source**: SupportedSources.SEMANTIC_SCHOLAR **journal**: **volume**: **doi**: 10.1093/mnras/stac1435 **urls**: • https://www.semanticscholar.org/paper/8957594ccb13ff320396860c81d10cb9b92d8083 **id**: id6730776413410190531 **abstract**: Relativistic plasmas are central to the study of black hole accretion, jet physics, neutron star mergers, and compact object magnetospheres. Despite the need to accurately capture the dynamics of these plasmas and the implications for relativistic transients, their fluid modeling is typically done using a number of (overly) simplifying assumptions, which do not hold in general. This is especially true when the mean free path in the plasma is large compared to the system size, and kinetic effects start to become important. Going beyond common approaches used in the literature, we describe a fully relativistic covariant 14-moment based two-fluid system appropriate for the study of electron-ion or electron-positron plasmas. This generalized Israel-Stewart-like system of equationsÂ of motion is obtained directly from the relativistic Boltzmann-Vlasov equation. This new formulation can account for non-ideal effects, such as anisotropic pressures and heat fluxes, not present in previous formulations of two-fluid magnetohydrodynamics. We show that a relativistic two-fluid plasma can be recast as a single fluid coupled to electromagnetic fields with (potentially large) out-of-equilibrium corrections. We keep all electron degrees of freedom, which provide self-consistent evolution equationsÂ for electron temperature and momentum. The out-of-equilibrium corrections take the form of a collisional 14-moment closure previously described in the context of viscous single fluids. The equationsÂ outlined in this paper are able to capture the full two-fluid character of collisionless plasmas found in black hole accretion and flaring processes around compact objects, as well Braginskii-like two-fluid magnetohydrodynamics applicable to weakly collisional plasmas inside accretion disks. **versions**:	DUPLICATES	965