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<tr><th>authors</th><td>Gilbert, Andrew D.
Vanneste, Jacques</td></tr>
<tr><th>title</th><td>A geometric look at MHD and the Braginsky dynamo</td></tr>
<tr><th>publication_date</th><td>2020-10-16 00:00:00</td></tr>
<tr><th>source</th><td>SupportedSources.CORE</td></tr>
<tr><th>journal</th><td>Geophysical & Astrophysical Fluid Dynamics</td></tr>
<tr><th>volume</th><td></td></tr>
<tr><th>doi</th><td>10.1080/03091929.2020.1839896</td></tr>
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<tr><th>id</th><td>id-7399694253333390704</td></tr>
<tr><th>abstract</th><td>This is the author accepted manuscript. The final version is available from Taylor & Francis via the DOI in this recordThis paper considers magnetohydrodynamics (MHD) and some of its applications from the perspective of differential geometry, considering the dynamics of an ideal fluid flow and magnetic field on a general three-dimensional manifold, equipped with a metric and an induced volume form. The benefit of this level of abstraction is that it clarifies basic aspects of fluid dynamics such as how certain quantities are transported, how they transform under the action of mappings (for example the flow map between Lagrangian labels and Eulerian positions), how conservation laws arise, and the origin of certain approximations that preserve the mathematical structure of classical mechanics. First, the governing equations for ideal MHD are derived in a general setting by means of an action principle, and making use of Lie derivatives. The way in which these equations transform under a pull back, by the map taking the position of a fluid parcel to a background location, is detailed. This is then used to parameterise AlfvÂ´en waves using concepts of pseudomomentum and pseudofield, in parallel with the development of Generalised Lagrangian Mean theory in hydrodynamics. Finally non-ideal MHD is considered with a sketch of the development of the Braginsky Î±Ï‰-dynamo in a general setting. Expressions for the Î±-tensor are obtained, including a novel geometric formulation in terms of connection coefficients, and related to formulae found elsewhere in the literature.Leverhulme TrustScience and Technology Facilities Council (STFC</td></tr>
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<tr><th>publication_date</th><td>2019-11-15 12:51:58+00:00</td></tr>
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