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**Machine learning predictions for magnetic field time evolution in a Three-Meter liquid sodium spherical Couette experiment**[1] ARTUR PEREVALOV, RUBEN ROJAS, BRIAN HUNT, DANIEL LATHROP, University of Maryland College Park — The source of the Earth's magnetic field is the turbulent flow of liquid metal in the outer core and its interaction with the present magnetic field. Our experiment's goal is to create an Earth-like dynamo to explore the mechanisms of generating magnetic fields and to understand the involved dynamics. Full numerical prediction is a challenging problem as it is strongly nonlinear and not computationally feasible to resolve. We present the implementation of various prediction techniques, including a reservoir computer deep learning algorithm, to probe the feasibility of using magnetic field data from the experiment to predict future measurements. The experiment is a three-meter diameter outer sphere and a one-meter diameter inner core model with the gap filled with liquid sodium. The spheres can rotate independently up to 4 and 14 Hz respectively, giving a Reynolds number up to $1.5 * 10^8$. Two external electromagnets apply magnetic fields, while an array of Hall sensors measure the resulting magnetic fields. We use this data to train a reservoir computer to predict Hall sensor measurements and mimic waves in the experiment. Surprisingly, accurate predictions can be made for several magnetic dipole time scales. This shows that such a MHD systems behavior can be predicted.

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