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Tracking Buoyant Magnetic Loops in a 3D Stellar Dynamo Simulation JOSE LUIS BARANDA, AUSTIN POLLARD, JARED SWEATMAN, NICHOLAS NELSON, California State University, Chico — The magnetic activity observed in Sun-like stars can strongly impact the potential habitability of Earth-like planets, just as our Sun's magnetic activity impacts the Earth's atmosphere and magnetosphere. Our project seeks to model the generation of stellar magnetism through convective dynamo action and how magnetic fields can bundle together into loops and rise from the deep interior to the surface of the star as sunspots. The rise of magnetic loops has been modeled using the thin flux tube (TFT) approximation and, more recently, using full 3D magnetohydrodynamics simulations. Our project involved developing analysis tools to track and quantify the physical processes involved in magnetic loop rise in a 3D MHD simulation in order to conduct detailed comparisons with TFT models. Preliminary results have suggested that TFT models have underestimated the strength of coupling between rising magnetic structures and surrounding convective flows, suggesting that further refinement may be required to better resolve the results between the two models.

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