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Electromagnetically Sustained Liquid Metal Flow for Feedback Stabilization Studies SEYYED MOHAMMAD MIRHOSEINI, FRANCESCO VOLPE, Columbia University — Liquid metal walls in fusion reactors, whether nearly static or rapidly flowing, will be subject to instabilities that will make them locally bulge, thus entering in contact with the plasma, or deplete, hence exposing the underlying solid substrate. To prevent this, research has begun at Columbia University to create liquid metal flows and demonstrate their stabilization by electromagnetic forces, adjusted in feedback with thickness measurements. Here we present initial results regarding the sustainment of a flow of Galinstan (a gallium, indium, tin alloy) by a special pump consisting of a ferromagnetic rotor, with permanent magnets mounted on it. The magnetic field is partly "frozen" in the liquid metal surrounding the rotor. Therefore, as the field rotates, the liquid metal rotates as well, although with a slip factor. This solution was preferred to conventional pumps, which would enter in electrical contact with the metal flow. The pump, 3D-printed at Columbia, allows to adjust the flow-velocity from few mm/s to several cm/s.

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