Plausibility of MRI in the Protolunar Disk following the High-Energy Giant Impact Scenario

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Approximately 4.5 Gyrs ago, it is hypothesized that a Mars-sized object (deemed "Theia") impacted Earth, the remnant debris disk subsequently coalescing into the Moon. The major evidence for this origin of the Moon is the similarity of the lunar and terrestrial compositions. Exactly when and how the mixing of the elements comprising the lunar interior occurred remains a source of contention; however, a new study presented by Carballido et al. (2016) is the first to constrain models using magnetohydrodynamics, namely a magneto-rotational instability (MRI) in simulations of the protolunar disk (PLD). MRI is the process by which turbulence is induced by the configuration of weak magnetic field lines threading a differentially-rotating, highly ionized disk. This scenario is possible if either Earth or Theia had a magnetic field at the time, and ionization calculations with data from Visscher and Bruce Fegley (2013) indicated that MRI was possible. In this talk, I will present a simulation of this MRI using instead the open source code PLUTO Mignone et al. (2007) and modeling a portion of the protolunar disk using the Shearing Box approximation algorithm. I also incorporated new precision chemical measurements predictions over a larger range of temperature into ionization and abundance calculations in an attempt to provide new constraints on the MRI in the PLD (Brugger et al., 2015).

References

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