# HOT HOLOGRAPHY: MAGNETIC RECORDING FIDELITY OF DUSTY OLIVINE.

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**Introduction:** Dusty olivine grains found within unequilibrated chondrites have the potential to have recorded early Solar System magnetic fields [1]. Understanding of the magnetic fields present during this period is crucial to models of the protoplanetary disk [2]. Estimates of the palaeomagnetic field from dusty olivine suggest magnetic fields played an important role in turning the protoplanetary disk into a planetary system [3]. Synthetic dusty olivine has proven to be a credible recorder of palaeomagnetic fields [4]. A recent study demonstrates that vortex state magnetite is capable of recording reliable thermoremanent magnetization [5].

**Methods:** Off-axis electron holography is a transmission electron microscopy technique that can be used to generate a magnetic induction map of the sample at the nanoscale [6]. Dusty olivine was prepared for TEM analysis by focused ion beam milling lamellae from a polished section of ordinary chondrite Bishunpur (BM 80339) onto DENS Solutions heating chips. By recording holograms whilst heating the lamella in-situ up to 800˚C and cooling back to room temperature, the remanent magnetisation of dusty olivine up to the Curie point can be fully observed.

**Results & Conclusion:** We present results from the full heating and cooling sequence of Fe metal found in dusty olivine. Despite chemical alteration above 600˚C, stable remanence and thermal unblocking are observed, as well as a recovery of remanence upon cooling. The heating and cooling sequence demonstrate the nanoscale thermoremanent stability and credibility of dusty olivine as a palaeomagnetic recorder.

**References:** [1] Leroux, H. et al. 2003. *MAPS*. 38:1: 81-94. [2] Wardle, M. 2007. Astrophys. Space Sci. 311: 35-45. [3] Fu R. R. et al. 2014 Science 346:6213: 1089- 1092. [4] Lappe, S. C. L. et al. 2011. Geochem., Geophys., Geosyst. 12:12. [5] Almeida, T. P. et al. 2014. Geophys. Res. Lett. 41:20: 7041-7047. [6] Midgley P. A. and Dunin-Borkowski R. E. 2009. Nature Materials 8: 271-280.