ESRF	**Experiment title:** Density of liquid Fe at high pressures and temperatures: equation of state and search for a liquid-liquid phase transition.	ESRF nt
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Names and affiliations of applicants (* indicates experimentalists):

C. Sanloup, School of Geosciences and CSEC, University of Edinburgh, UK
W. van Westrenen, de Vries University, Amsterdam, The Netherlands
H. Maynard, School of Physics and CSEC, University of Edinburgh, UK

Report:

Metallic Fe, in both solid and liquid state, is the dominant component of the cores of the terrestrial planets. Knowledge of its physical properties at high pressures and temperatures is critical for a wide variety of Earth Science and physics research fields ranging from magnetic field generation to cosmochemistry. However, crucial properties such as the equation of state of liquid Fe have not been measured yet under static high pressure conditions (1). It has long been known that solid Fe exhibits extensive polymorphism at the high pressures and temperatures in planetary cores. Positive identification of liquid Fe polymorphism would have particularly profound implications for geochemistry. In the case of liquid Fe, the first experimental indication of a possible structural change in the vicinity of the δ (bcc)-γ (fcc)-liquid triple point came from electrical resistivity measurements (2): above 5.2 GPa, the measured temperature coefficients of resistivity (TCR) increased discontinuously. Subsequently, X-ray scattering measurements on liquid Fe (to 2300 K and 5 GPa) revealed significant changes in short-range order upon increasing pressure and/or temperature (3).

During this experiment, the density of liquid Fe has been measured *in situ* in the Paris-Edinburgh cell up to 8 GPa by an X-ray absorption technique (see Fig.1). This technique, initially developed by Katayama (4), has been successfully extended to very high temperature (up to 2300 K) on ID27/30 (5, 6). Fe powder was loaded in a single-crystal diamond cylinder and P-T conditions were determined *in situ* from the X-ray patterns of internal calibrants inserted on the side of the cylinder (hBN, MgO and Pt).
A transition is identified by a compressibility change in the vicinity of the δ-γ-liquid triple point at 5.2 GPa. This transition provides a physical explanation for the marked modification in the pressure evolution of Ni partitioning between liquid metal and silicate (7).

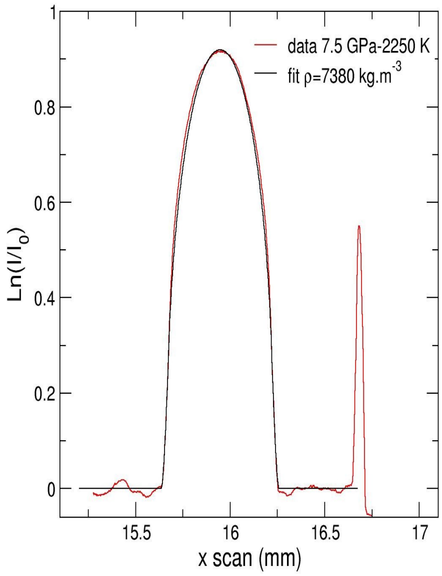

Fig.1: Absorption scan in liquid Fe at 7.5 GPa (the peak on the right hand side of the scan corresponds to the Pt foil inserted for P-T calibration purposes).

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3- Sanloup et al., *Europhys. Lett.,* 2000a, **52**, p.151.
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5- Sanloup et al., *Geophys. Res. Lett.,* 2000, **27**, p.811.
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7- Kegler et al., 2008, *Earth Planet. Sci. Lett*., **268**, p.28.