

Emission Spectroscopy of Dense Iron Plasma created at LCLS

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I will present the results of experiments at LCLS where we created and diagnosed iron plasma at temperature exceeding 1keV, and at solid iron (atomic) densities, with bulk electron densities greater than $2 \times 10^{24}/\text{cm}^3$. Using photon energies between 7100eV and 9000eV and pulse lengths less than 100 femtoseconds, we focussed the LCLS beam to a 120nm focal spot. A 2micron thin iron sample was placed in this focus and irradiated with intensities in excess of $10^{20} \text{ W}/\text{cm}^2$.

In this way, the heated iron foil reaches conditions (i.e. electron density and temperature) comparable to the stellar core condition in stars on the main sequence between 0.1 and 100 solar masses. The temperature we reached are relevant to emission seen from Galaxy clusters.

We compare the x-ray emission from the iron sample with atomic-kinetic calculation (i.e. SC-FLY). The analysis confirm the charges states and temperatures reached, and give a measure of the Ionization Potential Depression and collision rates in these dense plasmas.

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