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Hot electron transport in magnetized targets

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We report on further simulations for an experiment studying hot-electron transport in a magnetized planar target conducted on the OMEGA-EP laser system [1]. The magnetic field strength was set at 20 Tesla, which is sufficient to divert hot electrons and hinder their propagation toward a copper fluor layer. By analysing the heating of that layer by hot electrons both with and without the applied magnetic field, we intended to differentiate between radiative and hot-electron preheating. However, the experimental results were unexpected, as the K⊠ yields were similar with and without the applied magnetic field. In addition, broadening of the copper Kα lines was observed with the magnetic field.
To understand the experimental results, we have conducted 2-D MHD simulations with the FLASH code [2] and hot-electron transport simulations in a magnetized target with the 3D hybrid code PETRA [3]. One possible explanation that aligns with the findings of Enright and Burnett [4] is that the magnetic field increases the average energy of hot electrons, which are primarily gen-erated via SRS. With higher energy, these electrons can reach the fluor layer and produce increased Kα emission, like that achieved in the absence of the magnetic field. The broadening of the K⊠ emission from the copper layer when an external magnetic field is applied may be attributed to several effects that are still under investigation. These findings could help in managing hot-electron preheating in direct-drive central hot-spot ignition and shock-ignition targets.

References

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