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**Fusion related physics: Understanding the basic physics of High Energy Density Plasmas (HEDP) using ultra-short pulse laser-matter interactions<sup>1</sup>**  
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Nuclear fusion is one nature's most fundamental methods of generating energy. In stars, the fusion reactions that occur deep within stellar interiors generate radiation and particles that fill the Universe. For many years, a goal of scientists has been to utilize these processes on earth to generate energy. However, understanding the basic physics of the interacting particles is required to exploit this energy source. We present data and analysis from one technique (ultra-short pulse laser matter interactions) currently being used to understand this physics. High power, short pulse lasers offer the ability of studying matter heated to extremely high temperatures ( as high as 700 eV) and near solid density ( $10^{22}$  part/cm<sup>3</sup>). Two aspects of the basic physics will be presented, namely radiation absorption and particle energy exchange currently under investigation using these lasers.

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