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**Frontiers for discovery in high energy density physics**[1]

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Recent advances in extending the energy, power, and brightness of lasers, particle beams, and Z-pinch generators make it possible to create matter with extremely high energy density in the laboratory. The collective interaction of this matter, often in the plasma state, with itself, intense particle beams, and radiation fields, is a rapidly growing field of research called *high energy density physics*. It is a field characterized by extreme states of matter, previously unattainable in laboratory experiments, and not unlike the conditions occurring in many astrophysical systems. It is also a field rich in opportunities for scientific discovery and compelling applications, propelled by advances in high-performance computing and advanced instrumentation and measuring techniques. This plenary presentation will summarize the results of two recent national studies of high energy density physics commissioned by the National Academies – National Research Council, and the Office of Science and Technology Policy's Interagency Working Group on the Physics of the Universe. It will also provide an overview of the exciting research opportunities of high intellectual value in this highly interdisciplinary field, with examples ranging from fast ignition in inertial confinement fusion, to the creation of quark-gluon plasmas characteristic of the very early Universe using heavy ion accelerators. For purposes of this presentation, the working definition of *high energy density* refers to energy densities exceeding 100 kilojoules per cubic centimeter, or equivalently, pressures exceeding one megabar. For reference, the bulk moduli of solid materials under standard conditions are about 100 kilojoules per cubic centimeter.

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