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Prospects of high-energy-density research with use of intense heavy ions

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The equation of state (EOS) is the fundamental property of matter defining its individual properties. EOS is of fundamental interest and also it is required for numerical modeling of numerous processes arising under conditions of extreme energy densities. In this report we'll present an illustrative discussion of EOS problem for WDM. It includes methods of generation and research of high-energy-density states of matter along with a review of theoretical EOS models.

Measurements of isothermal compressibility in diamond anvil cells, data on sound velocity and density in liquid metals at atmospheric pressure, electrical explosion of conductors measurements, registration of shock compressibility for solid and porous samples in incident and reflected shock waves, impedance measurements of a shock compressibility under condition of an underground nuclear explosion, data on isentropic expansion of shocked metals and their importance for developing EOS are discussed. In spite of a significant progress achieved on construction of EOS, the range of an applicability of each theory is local and, rigorously speaking, no one of them allows to provide for a correct theoretical calculation of thermodynamic properties of matter on the whole phase plane from the cold crystal to liquid and hot plasmas.

The importance of intense heavy ion beams for generating high-energy-density states in matter in physical domains, which are interesting for fundamental science, have useful applications and are difficult to access by other methods, is discussed.

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