Pulse Power Compression by Cutting a Dense Z-Pinch with a Laser Beam

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A thin cut made through a z-pinch by an intense laser beam can become a magnetically insulated diode crossed by an intense ion beam. For larger cuts, the gap is crossed by an intense relativistic electron beam, stopped by magnetic bremsstrahlung resulting in a pointlike intense x-ray source. In either case, the impedance of the pinch discharge is increased, with the power delivered rising in the same proportion. A magnetically insulated cut is advantageous for three reasons: First, with the ion current comparable to the Alfvèn ion current, the pinch instabilities are reduced. Second, with the energy deposited into fast ions, a non-Maxwellian velocity distribution is established increasing the $\langle \sigma v \rangle$ value for nuclear fusion reactions taking place in the pinch discharge. Third, in a high density z-pinch plasma, the intense ion beam can launch a thermonuclear detonation wave propagating along the pinch discharge channel. For larger cuts the soft x-rays produced by magnetic bremsstrahlung can be used to drive a thermonuclear hohlraum target. Finally, the proposed pulse power compression scheme permits to use a cheap low power d.c. source charging a magnetic storage coil delivering the magnetically stored energy to the pinch discharge load by an exploding wire opening switch.