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Electromagnetically induced transparency in relativistic plasma

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We show that dense plasma becomes transparent for a low-frequency laser beam aided by another high-frequency laser beam [1]. Transport of a laser beam in dense plasma is eager in inertial confinement fusion and laser-driven particle acceleration, however which cannot usually be achieved according to classic plasma physics theory. Early in 1996, Harris proposed an electromagnetically induced transparency (EIT) mechanism to transport a low-frequency laser beam in dense plasma, analogous to the concept in atom physics. Subsequent studies asserted that EIT cannot work in real plasma in weakly-relativistic regime. Here, our theoretic investigation shows that EIT can occur when the laser intensity is relativistic, widely available in current laboratories. A frequency passband for EIT occurrence is presented and the passband is sufficiently wide only in relativistic regime, explaining disappearance of EIT in weakly-relativistic regime found in previous investigations. Besides clarifying the long-standing theoretic problem of EIT in plasma physics, this work can also be directly applied in fast ignition scheme or double-cone injection scheme of inertial confinement fusion to enhance laser transport and relativistic electron yield [2].

References

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