PASER: Particle Acceleration by Stimulated Emission of Radiation[*], L. SCHÄCHTER, TECHNION, Israel - When an electron moves in a dielectric material it may cause (Cerenkov) radiation to be emitted provided that its velocity is greater than the phase velocity in the medium. As a result, the electron is decelerated. It will be shown that if the passive dielectric medium is replaced by an active medium, the particle may accelerate. Thus energy stored in the medium can be transferred to the moving electron. At the microscopic level the process is as follows, consider an ensemble of atoms which each one is modelled by a two-level system. When an adequate virtual photon, associated with the moving electron, impinges upon an excited atom, it stimulates the atom and two identical (phase correlated) photons are emitted. Since the two are phase correlated, the real photon can be absorbed by the moving electron, accelerating it. The inverse process is also possible: if the virtual photon encounters an atom in the ground state and excites it, then the moving electron loses energy. We may expect net acceleration only if the number of atoms in the excited state is larger than these in the lower state i.e. the population is inverted.

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