Thermal Radiation of Hot Electrons

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Laser Power

The laser has a power of:

$$P(t) \propto e^{-(t-t_0)/2\sigma^2}$$

with a total energy:

$$E = \int S(t)dt = P_{\mathsf{Average}}/f \approx 1.2\,\mathsf{W}/100\,\mathsf{MHz} = 12\,\mathsf{uJ}$$

Absorption

only a fraction A=1 is absorbed into a volume given by the laser radius $r\approx 200\,\mathrm{um}$ and the optical depth $d\approx 250\,\mathrm{nm}$:

$$V = \pi r^2 \cdot d$$
$$S = \frac{P}{V} A$$

with $[S] = W/m^3$

e- Gas

The temperature change due to absorption can be calculated with the molar Volume $V_m = M/\rho$ and the specific heat capacity $c_e = 1/M \ dQ/dT$.

The lattice relaxation time $g \approx 300 \, \text{fs}$.

Diffusion is neglected. Radiative cooling is also ignored.

$$\frac{dT_e}{dt} = \frac{V_m}{c_e(T)}S$$
$$-\frac{T_e - T_l}{\sigma}$$



Validation





