

# Optical diagnostics in MagLiF conditions

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# Refraction on density gradients

$$D_2, \rho_0 = 1 \text{ mg/cc} (n_{a\_0} = 3 \cdot 10^{20} \text{ cm}^{-3})$$

$$R = 3.5 \text{ mm}, L = 5 \text{ mm}, B_0 = 20 \text{ T}, T_0 = 200 \text{ eV}$$

$$C_R = R_0/R \rightarrow n \sim C_R^2, B \sim C_R^2, T \sim C_R^{4/3}$$

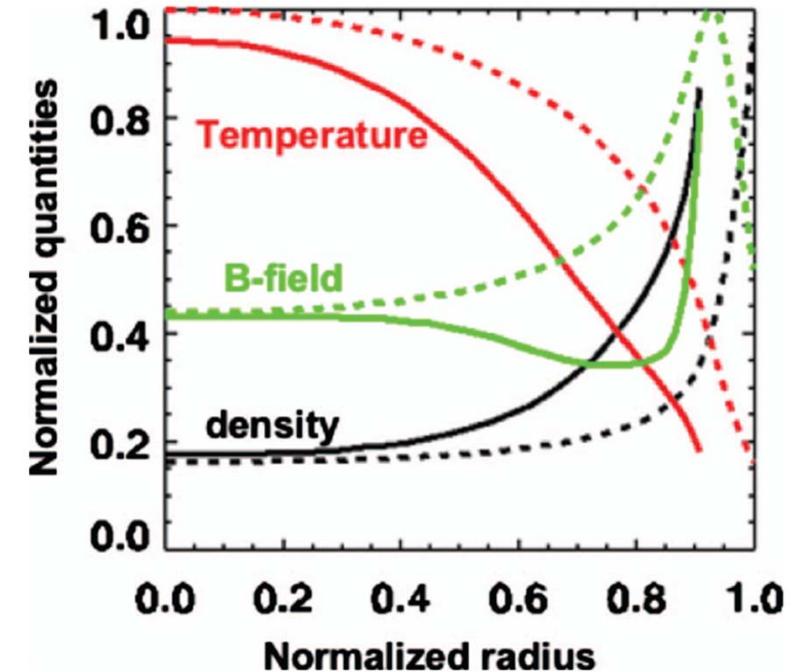
Laser probing:

$$\lambda = 0.355 \mu\text{m} (3\omega_0 \text{ Nd}) n_{cr} = 9 \cdot 10^{21} \text{ cm}^{-3}$$

Laser cut-off at  $C_R \sim 5.5$

Refraction on density gradients:  $\nabla n \sim n/R \sim C_R^3$

$$\theta_{ref} \approx \frac{1}{2n_{cr}} \nabla n_e L \approx 1 \text{ for } C_R = 2.4$$



Refraction could restrict probing possibilities even at early stages of compression



# Interferometry and Faraday rotation

Number of interference fringes):

$$F = \frac{\varphi}{2\pi} = 4.46 \cdot 10^{-18} \lambda_{[\mu m]} \cdot \int_{[cm^{-2}]} n_e dl \propto C_R^2$$

Laser  $\lambda = 0.355\mu m$  ( $3\omega_0$  Nd)  $\rightarrow F = 10^3$  for  $C_R = 2$

Faraday rotation:

$$\theta_{Far[rad]} = 2.26 \cdot 10^{-17} \lambda_{[cm]}^2 \int n_{e[cm^{-3}]} \vec{B}_{[G]} \cdot d\vec{l} \propto C_R^4$$

Laser  $\lambda = 0.355\mu m$  ( $3\omega_0$  Nd)  $\rightarrow \theta_{Far}/2\pi = 2$  for  $C_R = 2$ ;  $11$  for  $C_R = 3$

Faraday rotation in quartz fibre ( $\nu = 6.6$  rad/T/m):

$\theta \sim B \sim C_R^2$   $\theta/2\pi = 0.4$  for  $C_R = 2$ ;  $10$  for  $C_R = 10$



# Thomson scattering

$$\alpha \equiv \frac{1}{k\lambda_D} = \frac{1.08 \cdot 10^{-4} \lambda_{[cm]}}{\sin(\theta/2)} \left( \frac{n_e [cm^{-3}]}{T_e [eV]} \right)^{1/2} \propto C_R^{1/3}$$

**Scattering parameter  $\alpha \gg 1$**   
**collective scattering**

$\theta = 150^0$

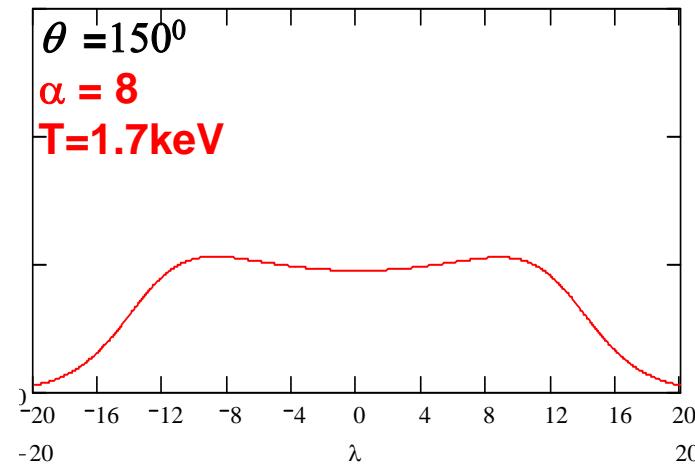
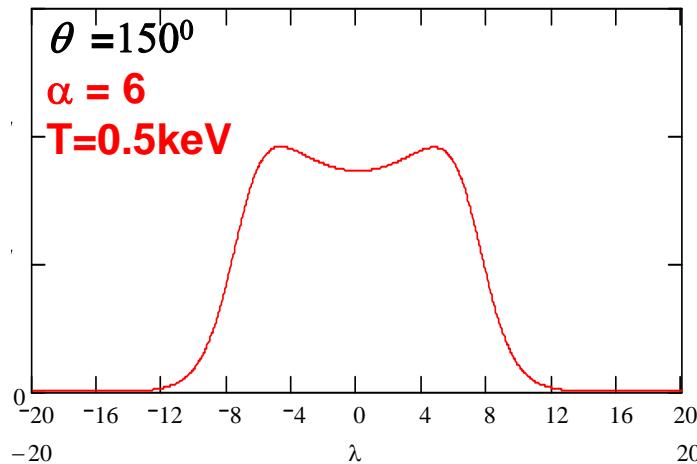
$\alpha = 6$

$\alpha = 8$

$\theta = 30^0$

$\alpha = 23$  for  $C_R = 2$

$\alpha = 31$  for  $C_R = 5$





# Test problem

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