

Schlieren Imaging at AWAKE

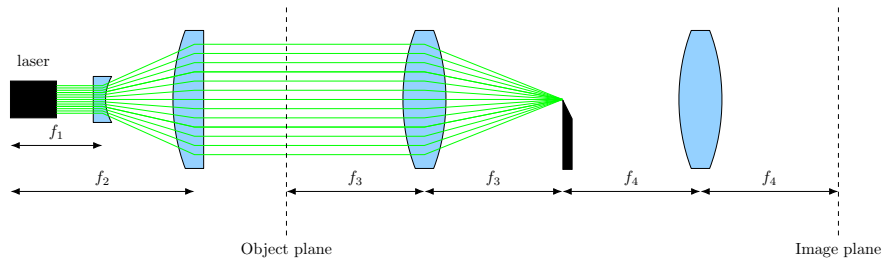
Felix Wechsler

Technical University of Munich

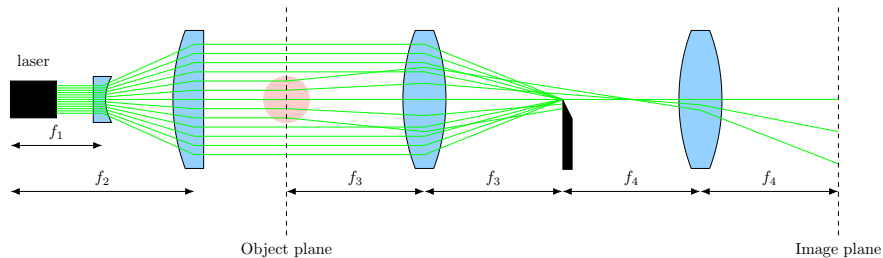
July 19, 2019



Setup

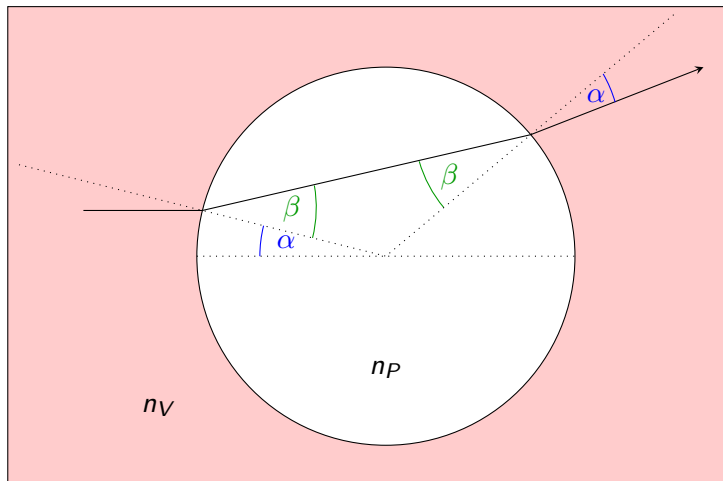


Setup



Plasma column acts as converging or diverging lens depending on λ

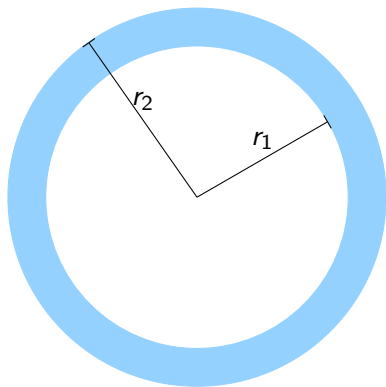
Focal length of plasma



Focal length can be derived:

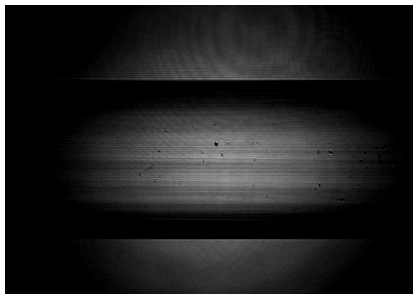
$$f = -\frac{R}{2(n_V - 1)}$$

Model plasma column with glass tube

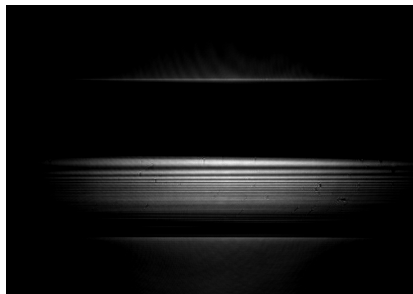


$$r_1 = 4 \text{ mm and } r_2 = 4.1 \text{ mm}$$

Experiment with capillary



without razor blade



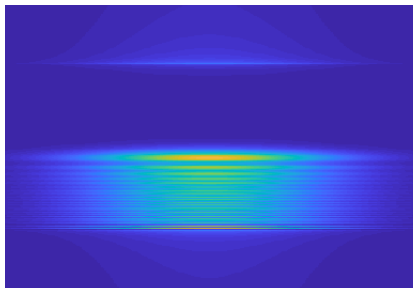
with razor blade

inner radius: $r_{in} = 4 \text{ mm}$

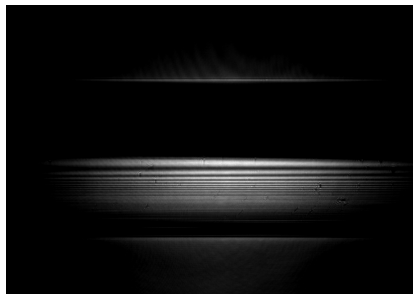
outer radius: $r_{in} = 4.1 \text{ mm}$

⇒ determination of radius is no problem

Comparison



numerical calculation



experiment

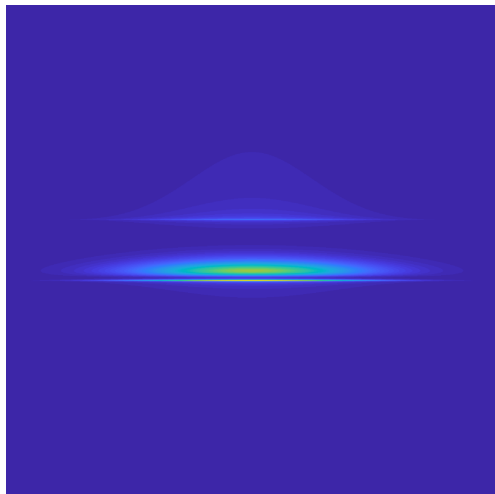
the focal length is *stored* inside the diffraction pattern

Variation of n

We can vary n of the rubidium column by tuning laser

Radius of column: $R = 1$ mm

index of refraction: $n = 1.00050$



Variation of n

We can vary n of the rubidium column by tuning laser

Radius of column: $R = 1$ mm

index of refraction: $n = 1.00080$



Variation of n

We can vary n of the rubidium column by tuning laser

Radius of column: $R = 1$ mm

index of refraction: $n = 1.00500$

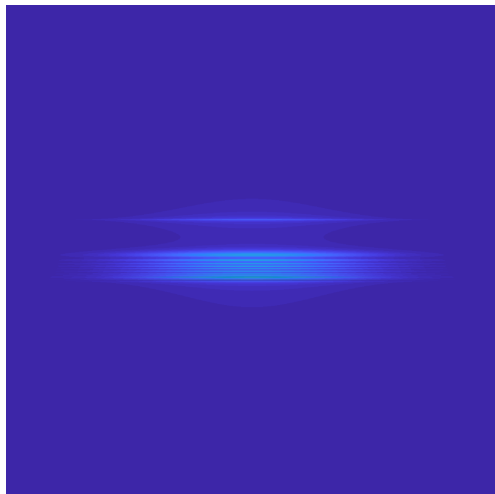


Variation of n

We can vary n of the rubidium column by tuning laser

Radius of column: $R = 1$ mm

index of refraction: $n = 1.00600$



Variation of n

We can vary n of the rubidium column by tuning laser

Radius of column: $R = 1$ mm

index of refraction: $n = 1.00700$



Variation of n

We can vary n of the rubidium column by tuning laser

Radius of column: $R = 1$ mm

index of refraction: $n = 1.00800$



Variation of n

We can vary n of the rubidium column by tuning laser

Radius of column: $R = 1$ mm

index of refraction: $n = 1.00900$



Variation of n

We can vary n of the rubidium column by tuning laser

Radius of column: $R = 1$ mm

index of refraction: $n = 1.05000$



Variation of n

We can vary n of the rubidium column by tuning laser

Radius of column: $R = 1$ mm

index of refraction: $n = 1.08000$



Variation of n

We can vary n of the rubidium column by tuning laser

Radius of column: $R = 1$ mm

index of refraction: $n = 1.10000$

