Ray Optics

- 6 x 2h lectures
- Instructor: Yvan Sortais
- Paraxial theory of ray optics
- Evaluation: homeworks (50%) + exam (50%)
- Pre-requisite for the Optical Design course by R. Mercier (theory of aberrations … beyond the paraxial theory)

Syllabus of the course

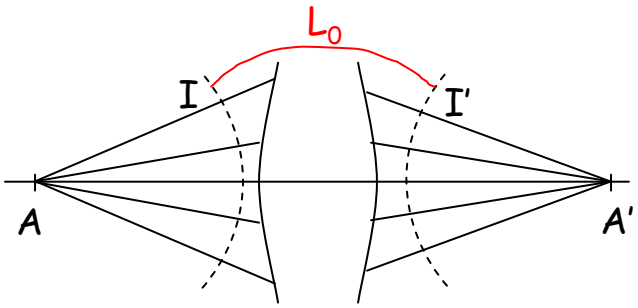
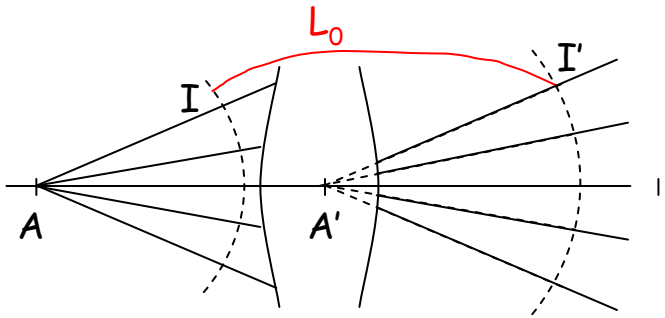
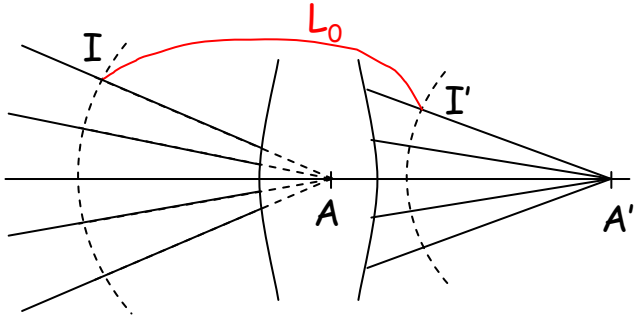
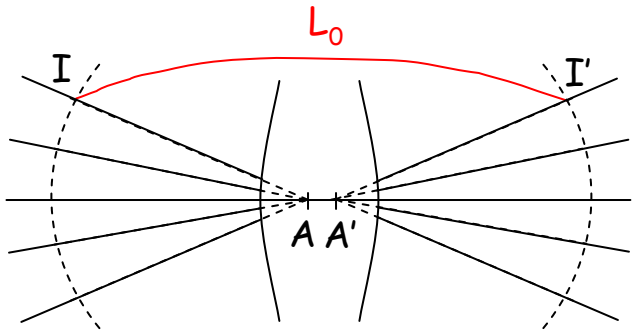
- Chapter 1 : general laws of ray optics (11/01)
- Chapter 2: rigorous and approached stigmatism (11/01)
- Chapter 3: Spherical dioptres and mirrors (14/01)
- Chapter 4: dioptric and catadioptric centred systems
- Chapter 5: simple lenses (21/01) + exercises (26/01)

} Paraxial theory

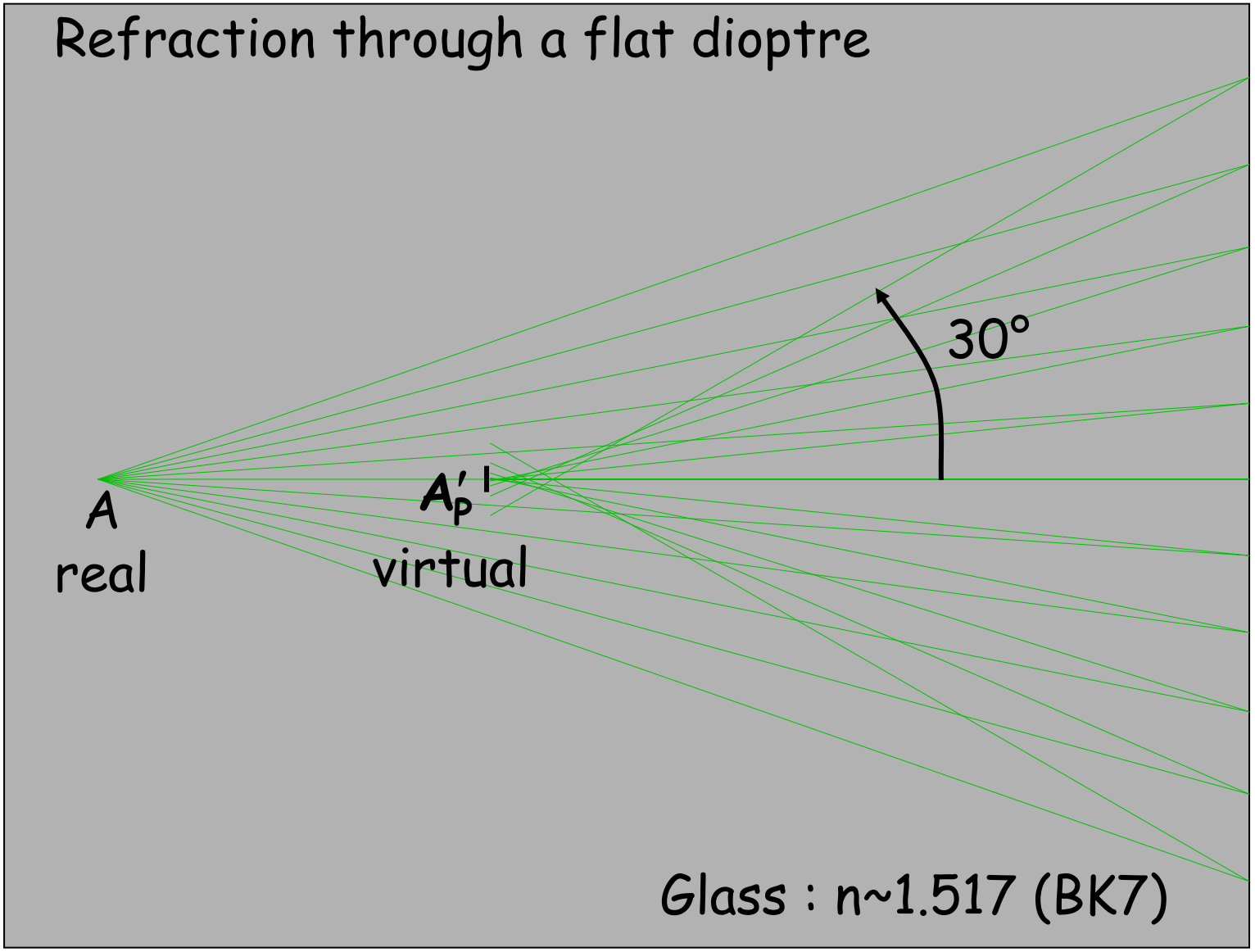
- Chapter 6: Properties of optical systems (04/02 & 11/02)

- Exam: 03/03/2011 – 09am→12pm

Optical path – real/virtual object/image

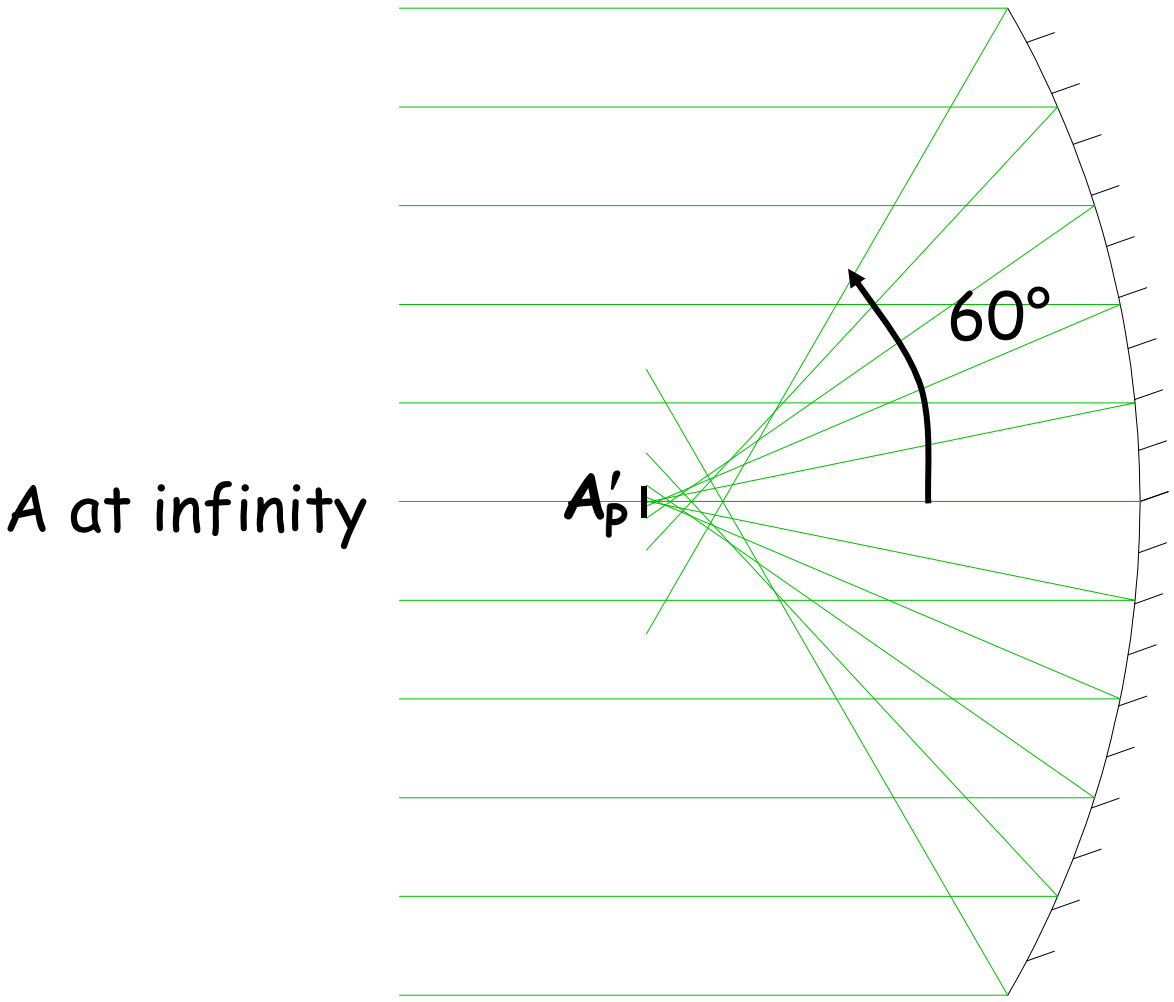
Object \ Image	Real	Virtual
Real	 $L_{AA'} = nAI + L_0 + n'I'A'$	 $L_{AA'} = nAI + L_0 - n'I'A'$
Virtual	 $L_{AA'} = -nAI + L_0 + n'I'A'$	 $L_{AA'} = -nAI + L_0 - n'I'A'$

Examples of not perfectly stigmatic systems (1)



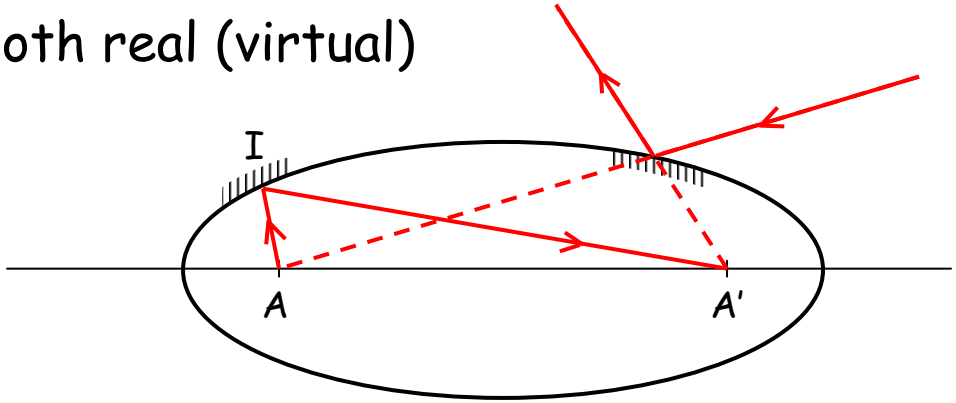
Examples of not perfectly stigmatic systems (2)

Reflection on a concave spherical mirror



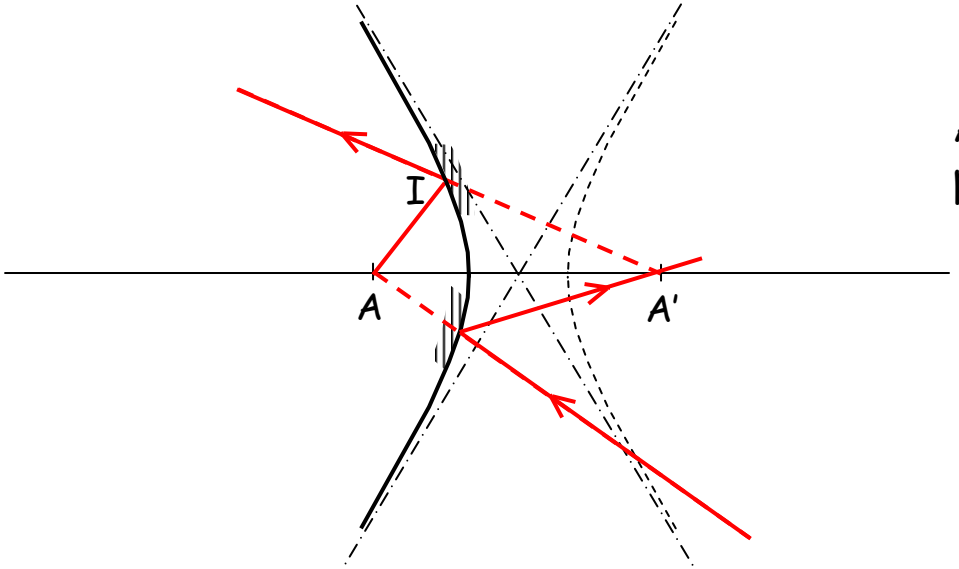
Stigmatic mirrors

- A and A′ are both real (virtual)



A and A′ are the focal points of an ellipsoid

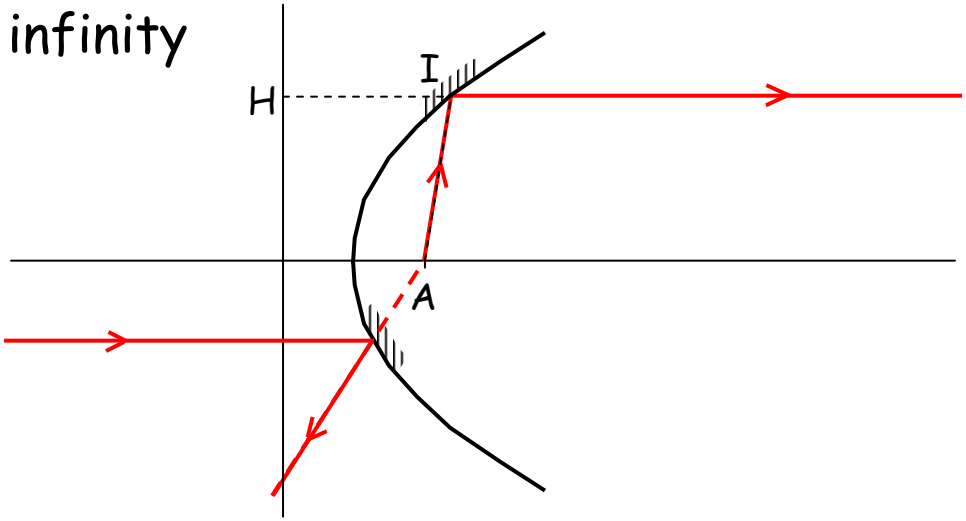
- A is real (virtual) and A′ is virtual (real)



A and A′ are the focal points of an hyperboloid

Stigmatic mirrors

- A (or A') is at infinity



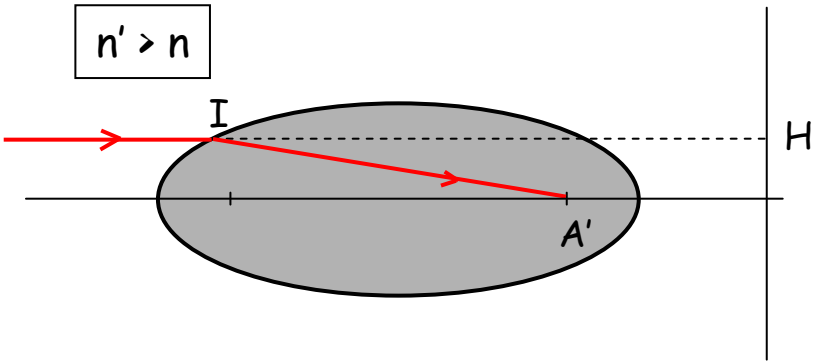
A (or A') is the focal point of a <u>paraboloid</u>

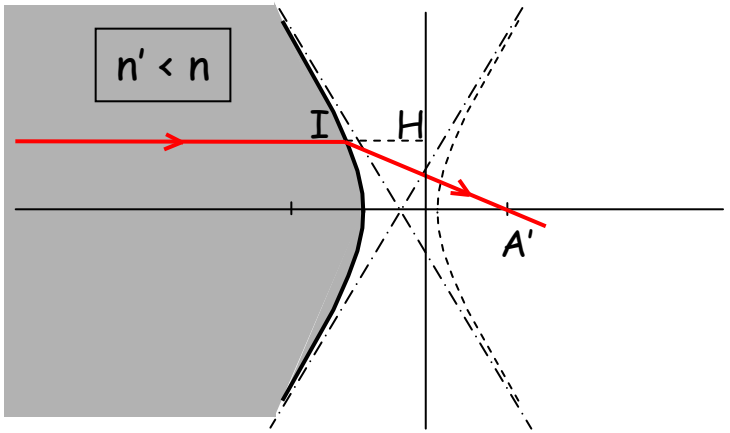
Stigmatic dioptres (1)

- Case (1) : A is at infinity

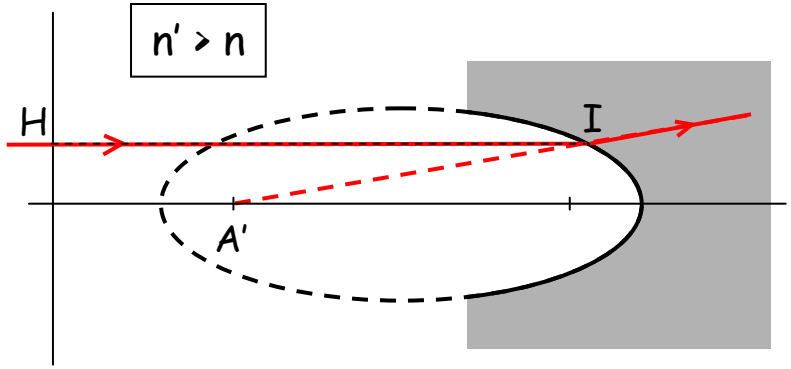
Stigmatism condition : $\frac{\overline{IA'}}{\overline{IH}} = \frac{n}{n'}$

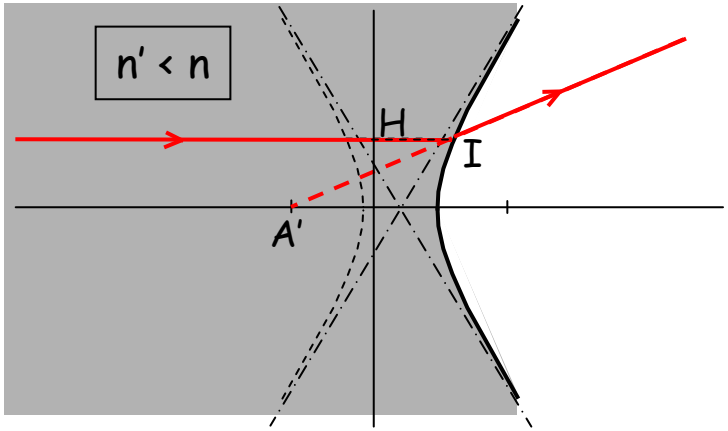
A' is real





A' is virtual



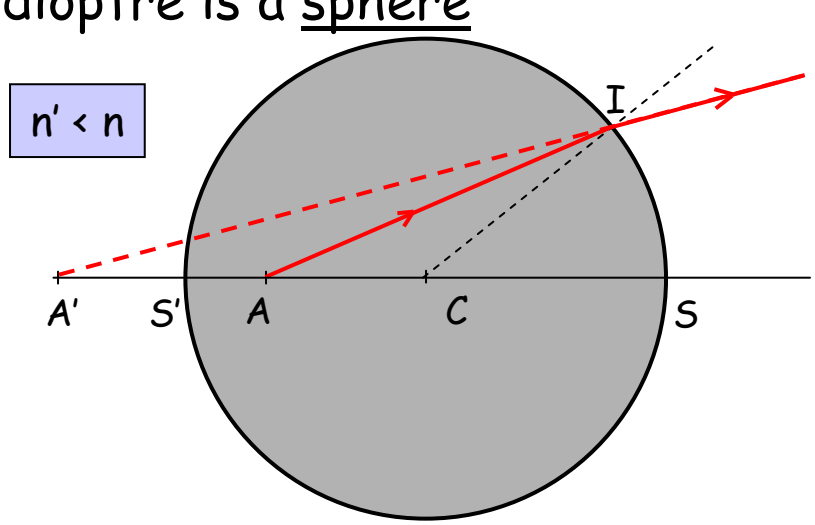


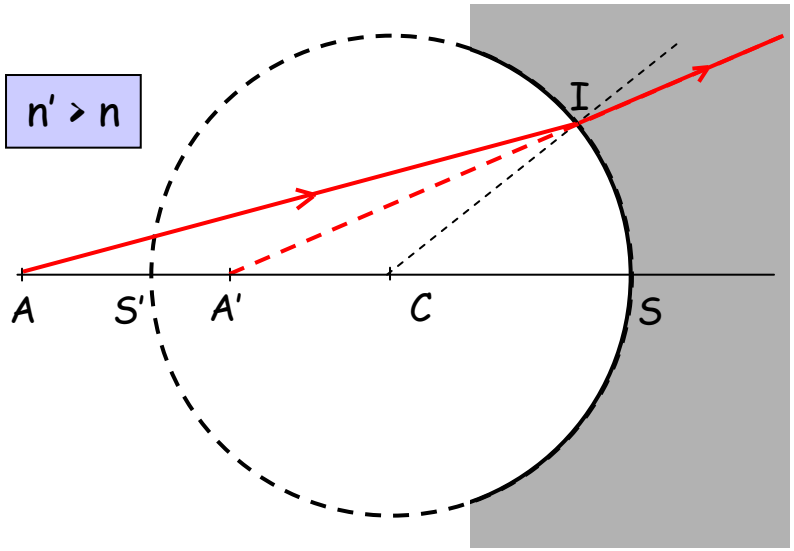
Stigmatic dioptres (2)

➢ Case (2) : $n\,\overline{AI} + n'\,\overline{IA'} = 0$

Equivalent to A real (virtual) and A′ virtual (real), and $\dfrac{IA'}{IA} = \dfrac{n}{n'}$

The dioptre is a sphere





A and A′ are the Young-Weierstrass points

$$\frac{\overline{S'A'}}{\overline{S'A}} = -\frac{\overline{SA'}}{\overline{SA}} = -\frac{n}{n'}$$ and

$$\begin{cases} \overline{CA} = \dfrac{n'}{n} R \\ \overline{CA'} = \dfrac{n}{n'} R \end{cases}$$ with $R = \overline{SC}$