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## Lecture 20

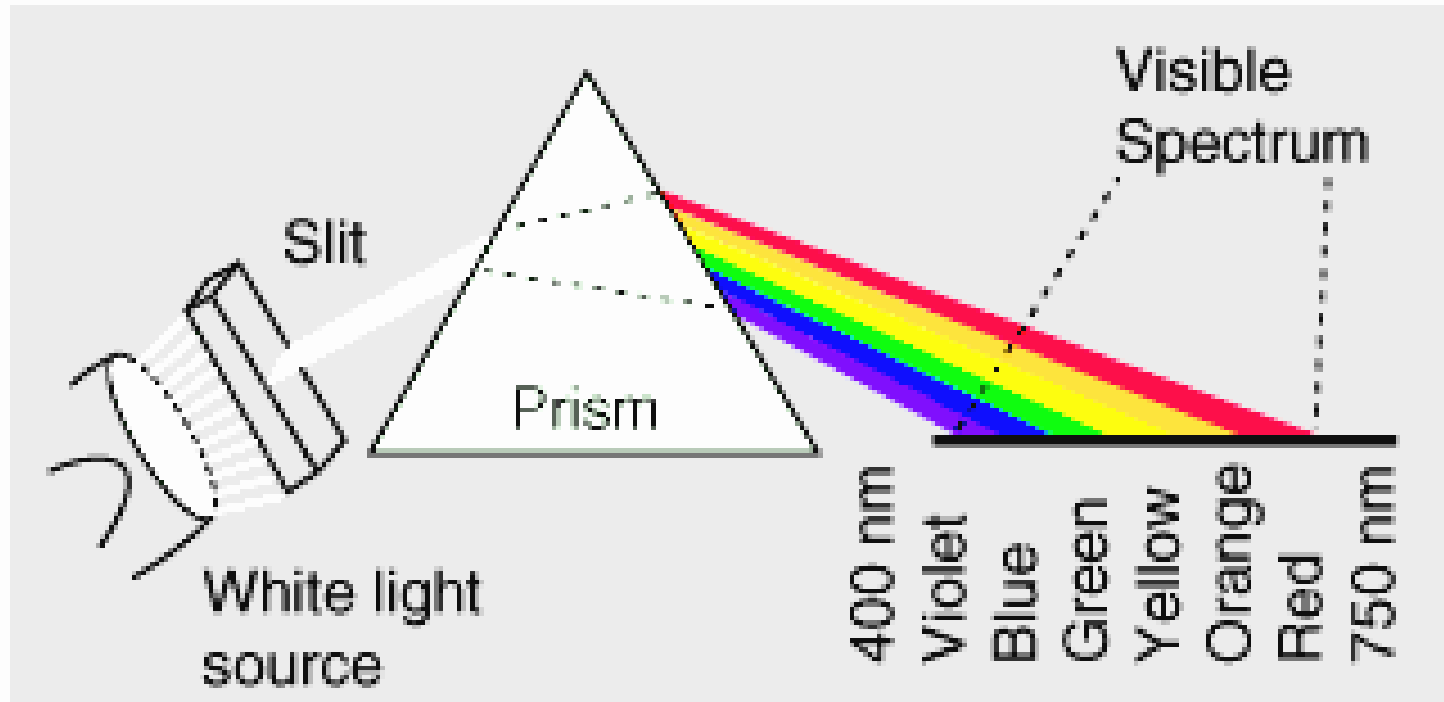
- Chromatic dispersion
  - Total internal reflection: optical fibers; applications
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- *Halliday, Resnick, Walker: Fundamentals of Physics, 6<sup>th</sup> ed. Ch. 34 (34.7, 34.8), Ch. 35 (35.1, 35.5); 7<sup>th</sup> ed. Ch. 33 (33.8, 33.9)*
  - *Hyper Physics: <http://hyperphysics.phy-astr.gsu.edu>*  
*Pictures from Hyper Physics are used by permission*
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## Lecture 20

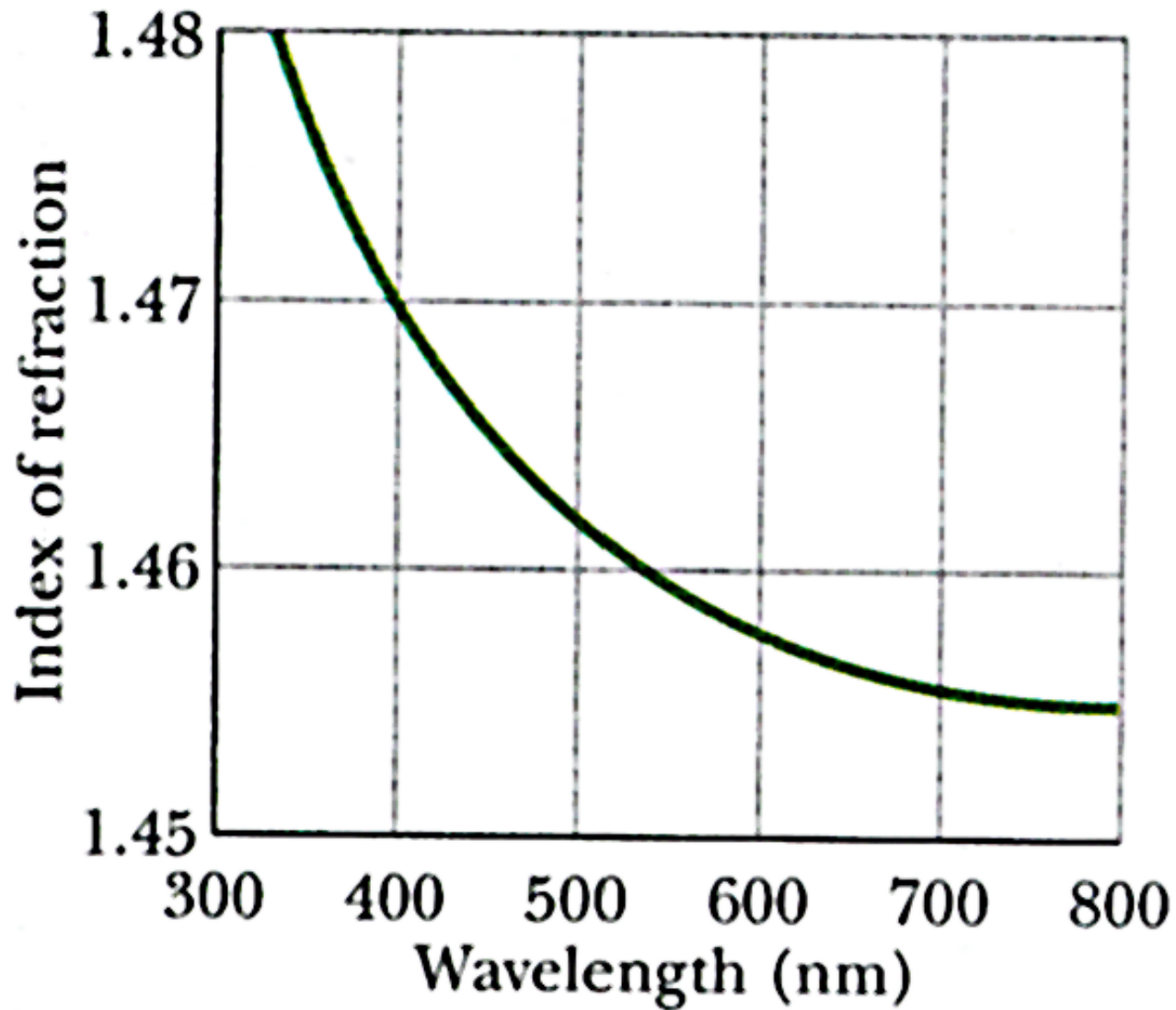
### ■ The index of refraction: $n = c/v$

<b>Vacuum</b>	1.0000	<b>Ice</b>	1.31
<b>Air</b>	1.000277	<b>Polystyrene</b>	1.59
<b>Water</b>	4/3	<b>Crown glass</b>	1.50-1.62
<b>Ethyl alcohol</b>	1.362	<b>Flint glass</b>	1.57-1.75
<b>Glycerine</b>	1.473	<b>Diamond</b>	2.417

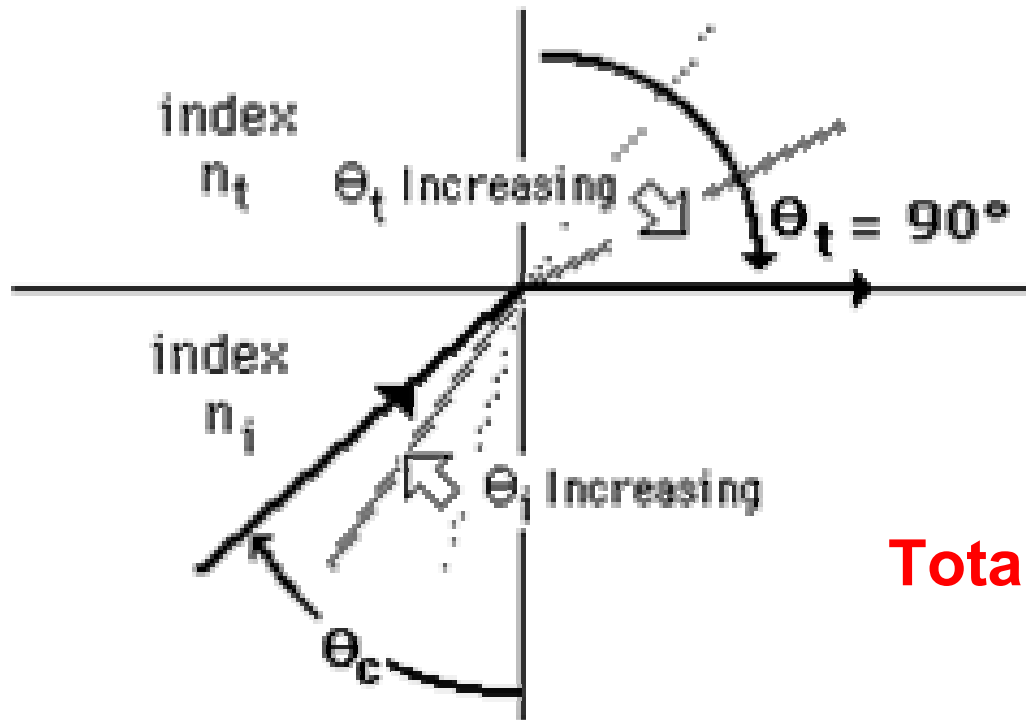
## Lecture 20



- Spreading of light = chromatic dispersion
- It is determined by the dependence of  $n$  (index of refraction) with wavelength



## Lecture 20

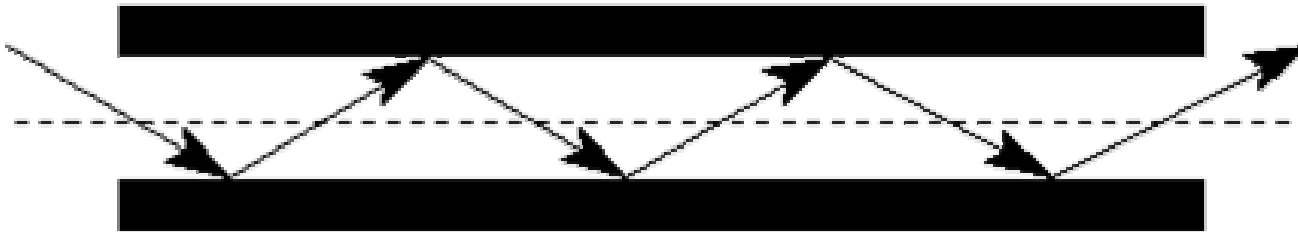


$$n_i \sin \theta_c = n_t \sin 90^\circ$$

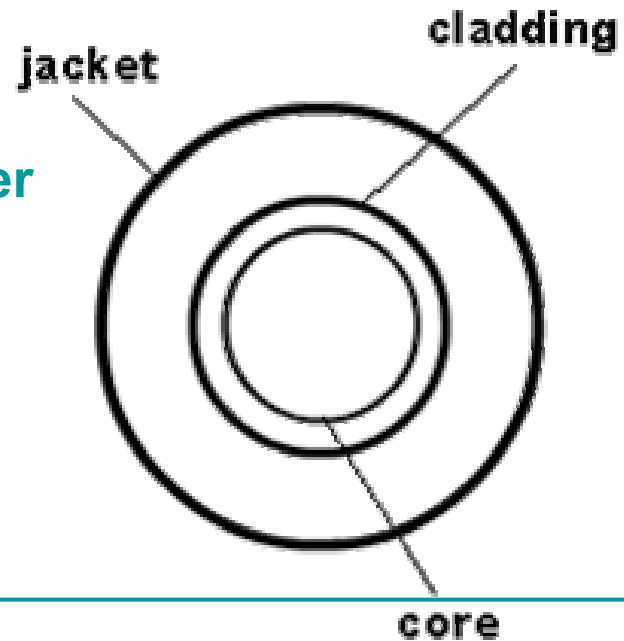
**Total internal reflection**

## Lecture 20

- Optical fibers use total internal reflection

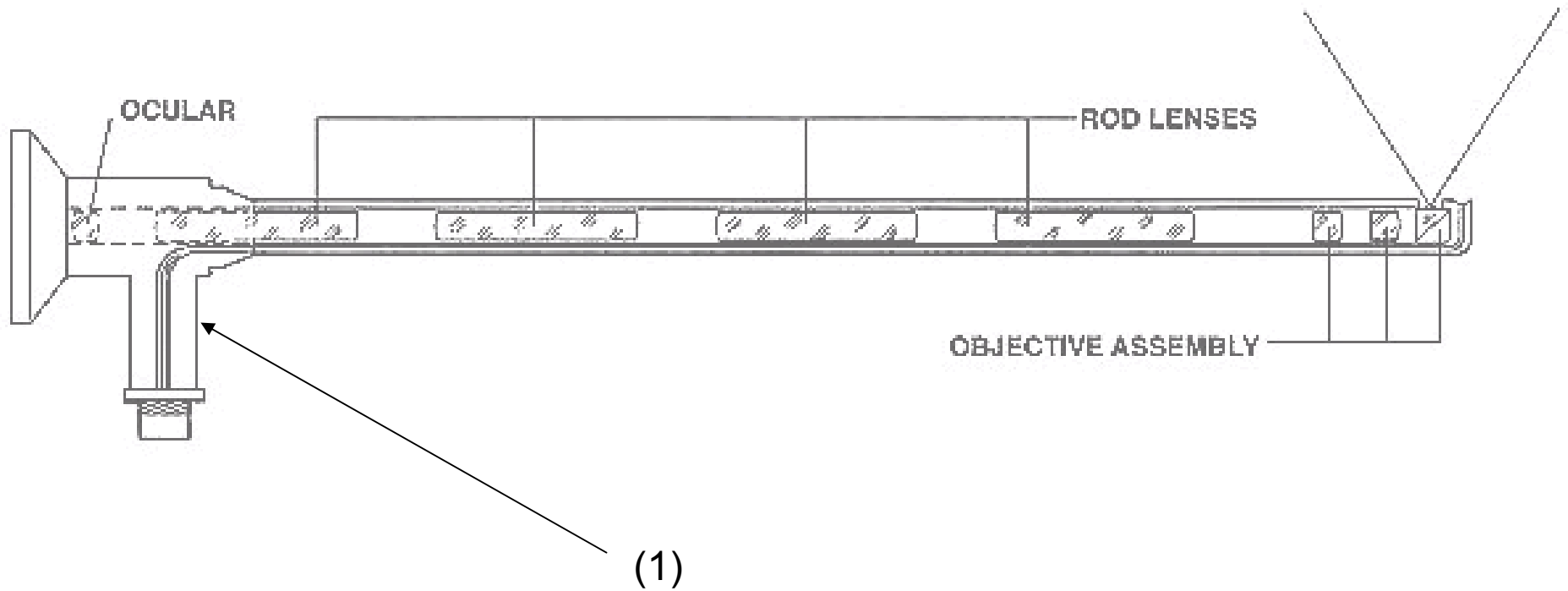


Transverse section of an optical fiber

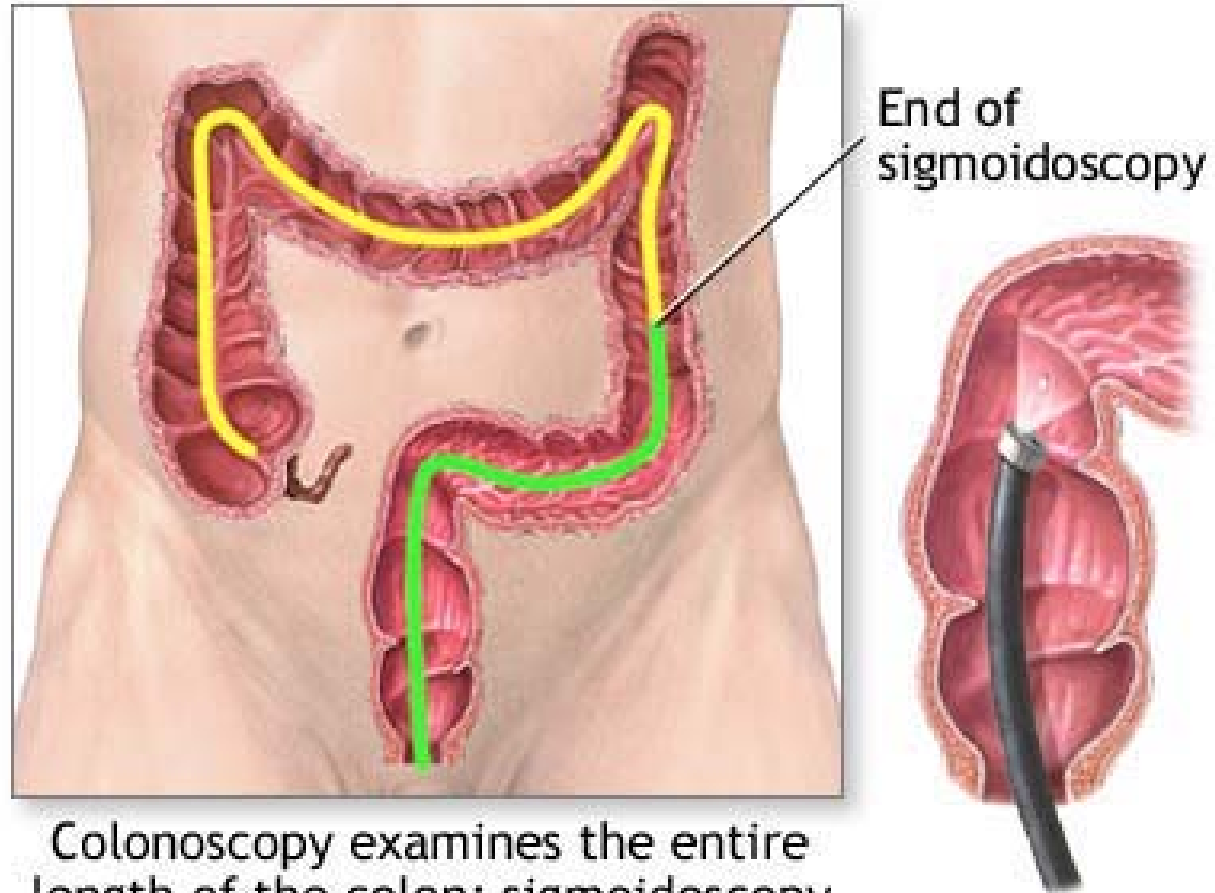


## Lecture 20

- The endoscope: uses a “carrier” fiber optic line (1)



## Colonoscopy



Colonoscopy examines the entire length of the colon; sigmoidoscopy examines only the lower third

## Lecture 20

**Sigmoid colon,  
as seen by  
the endoscope**

[www.gastrolab.net/ksgcolo2.htm](http://www.gastrolab.net/ksgcolo2.htm)

[www.gastrolab.net/v009y.avi](http://www.gastrolab.net/v009y.avi)  
(videoclip)

