

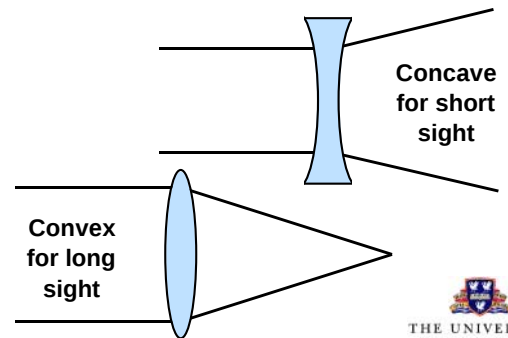
# Keeping an Eye on the Universe

## Keeping an Eye on the Universe

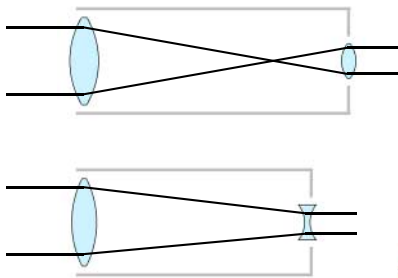
The development of the astronomical telescope from the Middle Ages to the new millennium

Dr Steve Barrett

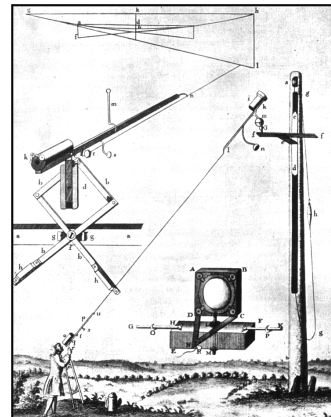
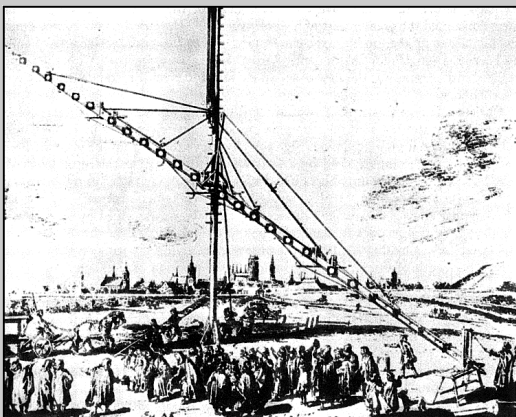
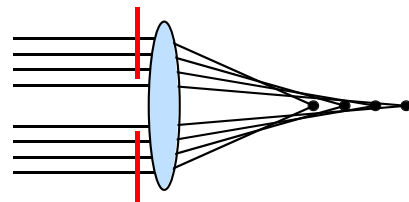
## Spectacle Lenses



## Galileo and Kepler

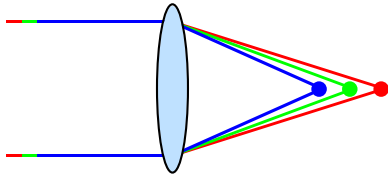


## Spherical Aberration



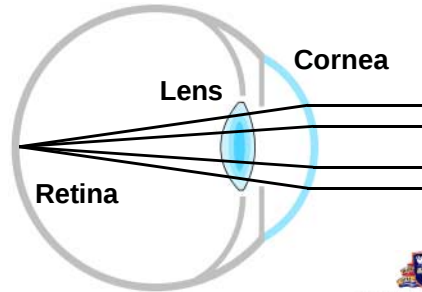
# Keeping an Eye on the Universe

## Chromatic Aberration



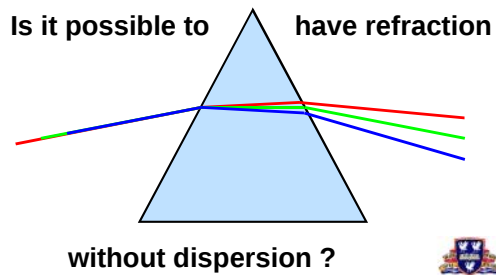
THE UNIVERSITY  
of LIVERPOOL

## Kepler and the Human Eye



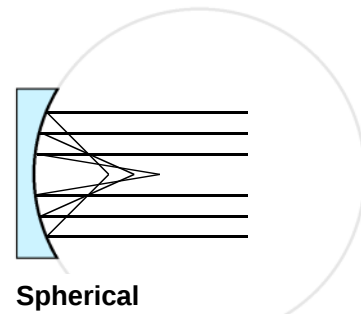
THE UNIVERSITY  
of LIVERPOOL

## Refraction and Dispersion



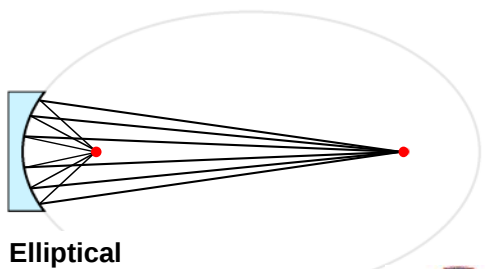
THE UNIVERSITY  
of LIVERPOOL

## Reflecting Mirrors



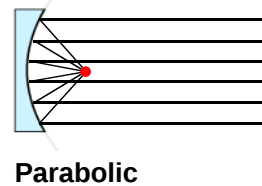
THE UNIVERSITY  
of LIVERPOOL

## Reflecting Mirrors



THE UNIVERSITY  
of LIVERPOOL

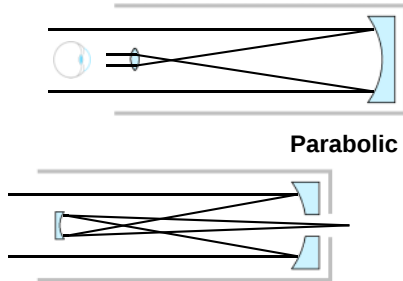
## Reflecting Mirrors



THE UNIVERSITY  
of LIVERPOOL

# Keeping an Eye on the Universe

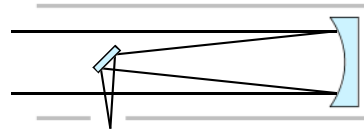
## Reflecting Telescopes



Parabolic

THE UNIVERSITY  
of LIVERPOOL

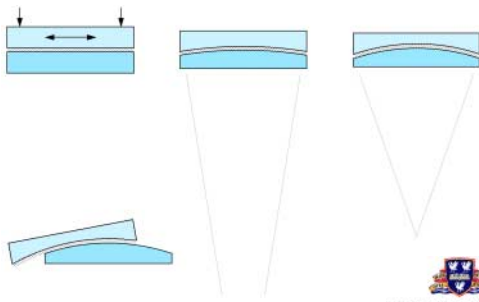
## Newtonian Telescope



Spherical

THE UNIVERSITY  
of LIVERPOOL

## Why Spherical?



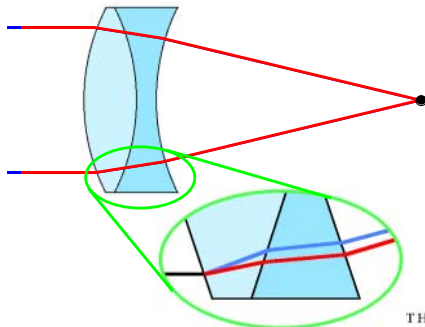
THE UNIVERSITY  
of LIVERPOOL

## Refractors vs Reflectors

|      |                   |  |            |
|------|-------------------|--|------------|
| 1600 | Galileo<br>Kepler |  | Newton     |
| 1650 |                   |  | Cassegrain |
| 1700 | Hevelius          |  |            |
| 1750 | Hall<br>Dolland   |  | Hadley     |
| 1800 |                   |  |            |

THE UNIVERSITY  
of LIVERPOOL

## Achromatic Lens



THE UNIVERSITY  
of LIVERPOOL

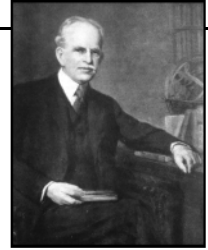
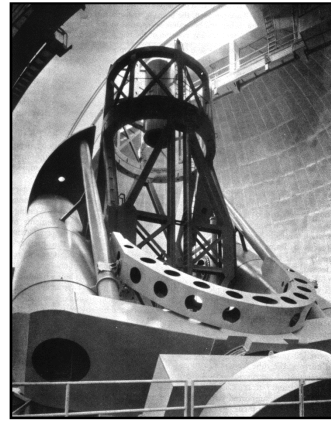
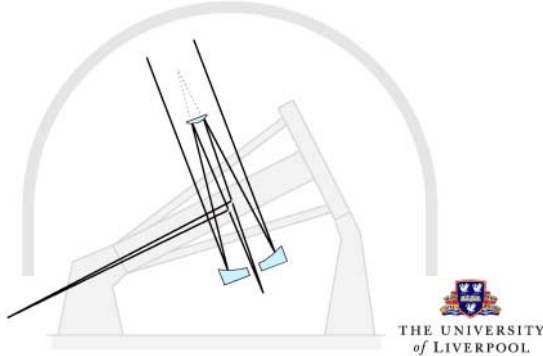
## Death of the Refractor

|      |                      |                       |
|------|----------------------|-----------------------|
| 1800 | Largest Refractor 6" | Largest Reflector 18" |
| 1850 | ↓                    | Silvered Glass        |
| 1900 | Yerkes 40"           | Hooker 100"           |
| 1950 |                      | Hale 200"             |
| 2000 |                      | ↓                     |

THE UNIVERSITY  
of LIVERPOOL

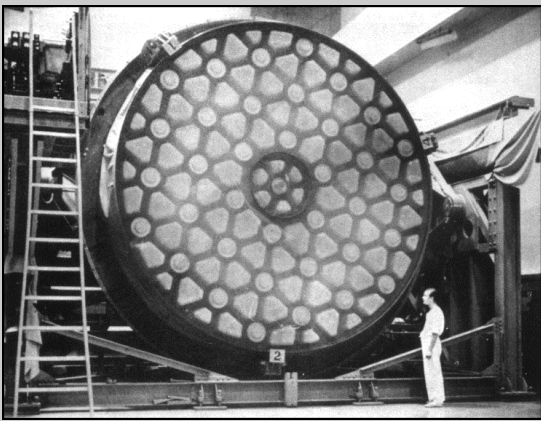
# Keeping an Eye on the Universe

## Hale 5 m Reflector

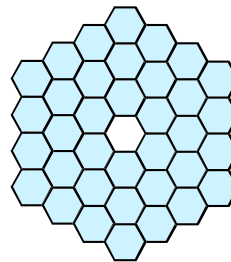


George Hale

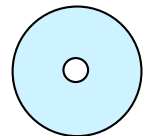
THE UNIVERSITY  
of LIVERPOOL



## The New Millennium



Keck 10 m



Hale 5 m

THE UNIVERSITY  
of LIVERPOOL