An Grúpa Optaice Feidhmí

applied Optics PHYSICS

NUI Galway
OÉ Gaillimh

sfi
science foundation ireland

Wide Field Imaging for Sky Survey

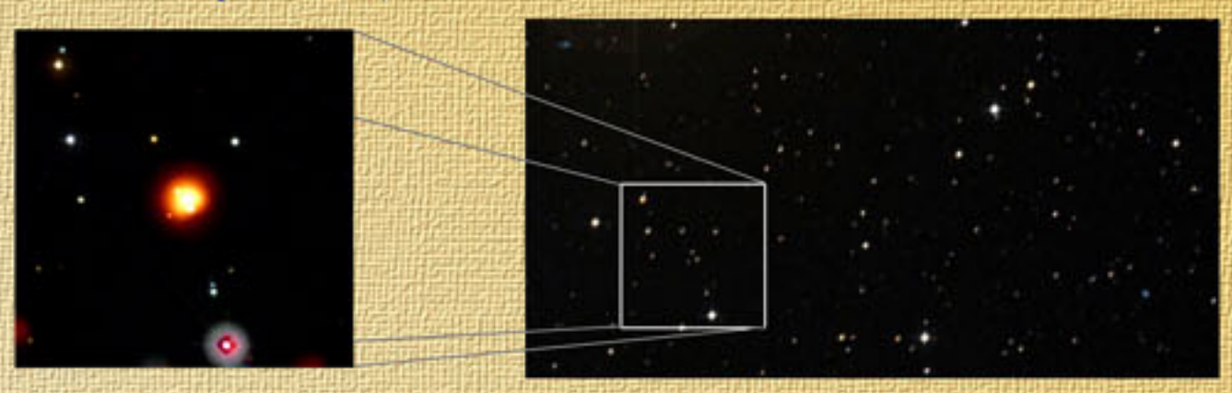
Mehdi Bahrami, Alexander V Goncharov

Sky Survey

is imaging of relatively large regions of the sky using telescopes.

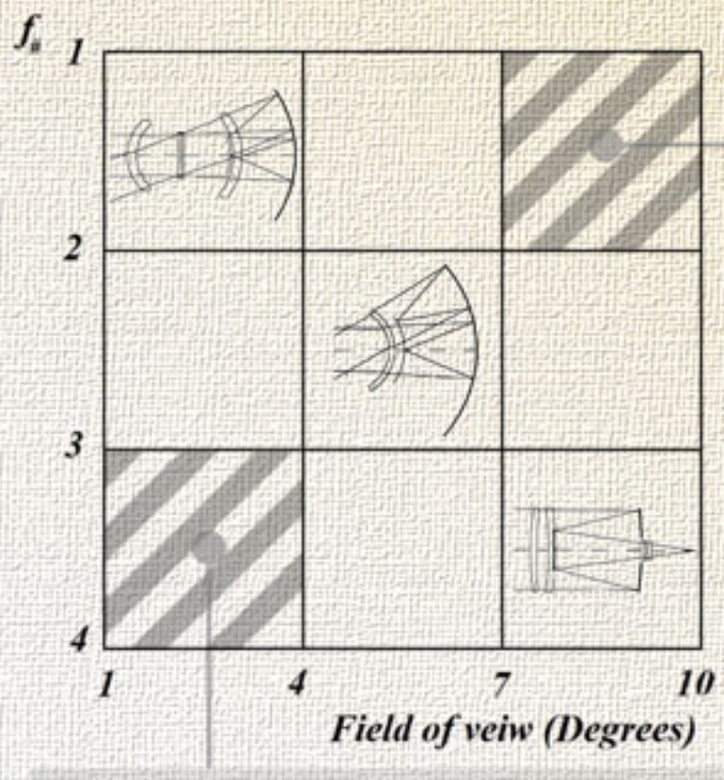
This could be useful for ▶

- Finding interesting parts of the sky for more targeted observations e.g. Gamma-ray bursts, or birth of a new star



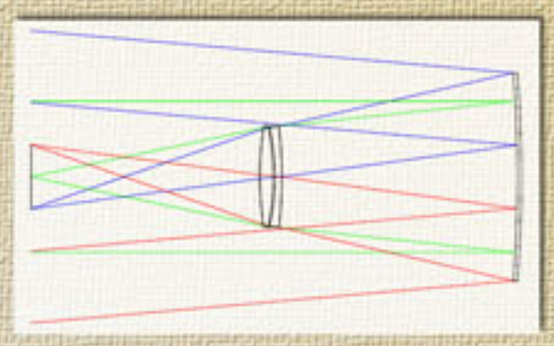
- Searching for moving foreground objects e.g. asteroids, satellites, and comets

Imaging a vast area of the sky in one shot needs telescopes with a wide field of view. On the other hand, because of current limitations in manufacturing large CCDs these telescopes should have fast focal ratios, which makes the optical designs challenging. Although traditionally, having a large field of view demands aspherical surfaces, large lenses, or even complicated folded designs, but classical principles can still help us to find undiscovered and sometimes unsuspected cost-effective systems. To study this, we are going to explore new systems in the framework shown below. We have done already the study of telescope designs in the shaded corners of the framework.

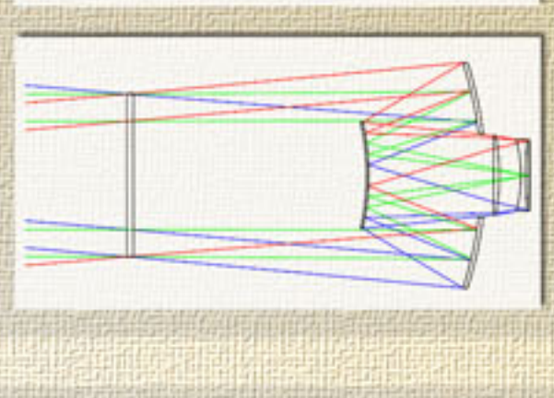


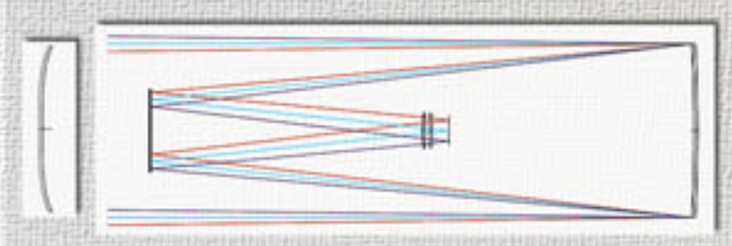
F/2.5 system with 10 degrees field of view

The primary mirror in this design has an even aspheric surface. A large achromatic doublet is used as the focal corrector. The root mean square (RMS) spot radius is less than 25 microns.

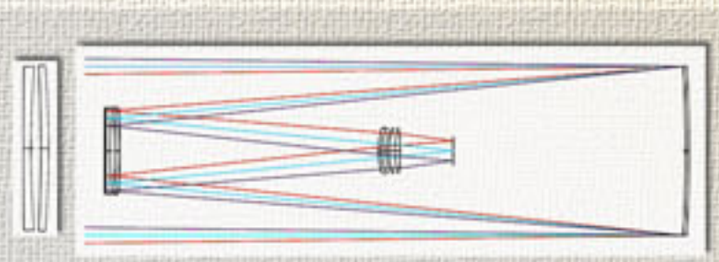


Another design is an equivalent system but with a spherical primary and secondary mirror. This system uses the Schmidt principle then the mirrors are concentric with the centre of the Schmidt plate located at the entrance pupil. A two-lens corrector is used as a field corrector.

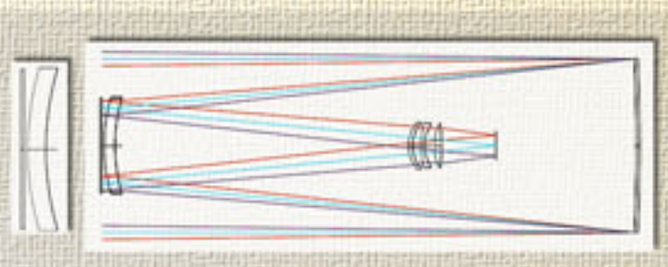




F/4.5 system, 1.5 degrees field of view
The primary mirror is a hyperboloid of revolution and the secondary mirror is a planoid asphere. Although the system is not diffraction limited, but the telescope performance is better than atmospheric seeing.



The planoid asphere is replaced by a spherical Mangin mirror and a meniscus corrector. The well-known two-lens corrector is replaced by a three-lens orrector with three different types of glass. As a result the system is diffraction limited.



During this research we discovered that in the system with no optical power on the secondary mirror the glass in the Mangin mirror can be omitted without a noticeable change in the image quality.