Optical Immersion

Optical immersion is achieved by using high refractive index microlenses in order to improve performance of the devices but may limit acceptance angle.

Optical immersion is monolithic integration of detector element with hyperhemispherical microlens (basic configuration) that makes optical size of detector 11 times larger compared to its physical size. This results in improvement of D* by one order of magnitude and electric capacitance by a factor of two orders of magnitude less compared to conventional detector of the same optical area.
Function and properties of **hemispherical** and **hyperhemispherical** lenses are illustrated in the Figure and the Table below.

Parameter	Symbol	Hemisphere		Hyperhemisphere	
		Theory	GaAs	Theory	GaAs
Distance	L	R	R	R(n+1)	4.3R
-	$\frac{d}{d'}$	n	3.3	n^2	10.9
-	$\frac{D^*_{imm}}{D^*_{non-imm}}$	n	3.3	n^2	10.9
Acceptance Angle	Φ	180°	180°	2arcsin(1/n)	35°
F/#	-	0.5	0.5	n/2	1.62

Table. Immersed Detectors Parameters

n – a refractive index of a lens material (~3.3 for GaAs used by VIGO)
d – optical (apparent) detector size
d' – physical detector size
R – lens radius
L – lens face to objective focal plane distance
$h = R + \frac{R}{n}$ - lens thickness

The values in the above Table show the relative change of a given parameter comparing to a non-immersed detector of the same optical size.
Detectors with custom **acceptance angles** are available upon request.

Immersion Technology is described in *"Infrared Detectors and Systems"*, E.L. Dereniak and G.D. Boreman, Wiley Interscience, 2000.

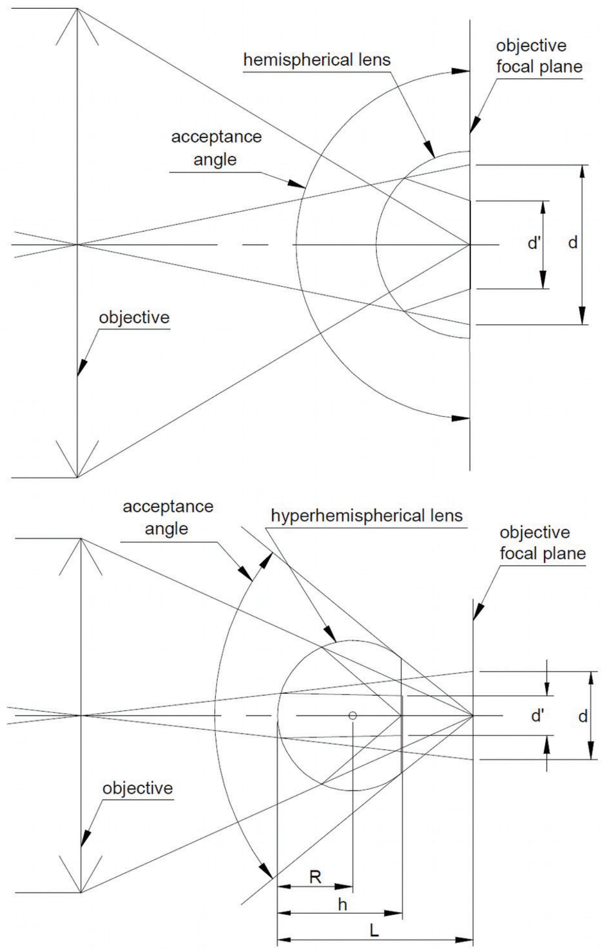

Figure. Function and properties of hemispherical and hyperhemispherical lense