Optical design

OPTI 502L Optical Design and Instrumentation I

University of Arizona

Nicolás Hernández Alegría

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		Object		EP		L_1 (stop)		Field		L_2		XP		Image
	f t n				$z_{EP} =$ 1	f_1	d_1 1	f_f	d_2 1	f_2	$z_{XP} = ER$ 1		$z' =$ 1	
	$-\phi$ τ				$\tau_{EP} =$	$-\phi_1$	τ_1	$-\phi_f$	τ_2	$-\phi_2$	$\tau_{XP} = ER$		$\tau_{z'} =$	
PCR	y nu				0.1	0	0.1	$0.1\tau_1$	$0.1 - 0.1\phi_f\tau_1$	$0.1\tau_1 + \tau_2(0.1 - 0.1\phi_f\tau_1)$	$(0.1 - 0.1\phi_f\tau_1) - \phi_2[0.1\tau_1 + \tau_2(0.1 - 0.1\phi_f\tau_1)]$	0		
PMR	y nu			1	0	1	$-\phi_1$	$1 - \phi_1\tau_1$	$-\phi_1 - \phi_f(1 - \phi_1\tau_1)$	$(1 - \phi_1\tau_1) + \tau_2[-\phi_1 - \phi_f(1 - \phi_1\tau_1)]$	$-\phi_1 - \phi_f(1 - \phi_1\tau_1) - \phi_2\{(1 - \phi_1\tau_1) + \tau_2[-\phi_1 - \phi_f(1 - \phi_1\tau_1)]\}$	a'_{XP}	//	0

$$\tau_{XP} = ER = -\frac{0.1\tau_1 + \tau_2(0.1 - 0.1\phi_f\tau_1)}{(0.1 - 0.1\phi_f\tau_1) - \phi_2[0.1\tau_1 + \tau_2(0.1 - 0.1\phi_f\tau_1)]} > 0, \quad \tau_{EP} = -\infty$$
$$a'_{XP} = (1 - \phi_1\tau_1) + \tau_2[-\phi_1 - \phi_f(1 - \phi_1\tau_1)] + \tau_{XP}\left[-\phi_1 - \phi_f(1 - \phi_1\tau_1) - \phi_2\{(1 - \phi_1\tau_1) + \tau_2[-\phi_1 - \phi_f(1 - \phi_1\tau_1)]\}\right]$$
$$\phi = -\left[-\phi_1 - \phi_f(1 - \phi_1\tau_1) - \phi_2\{(1 - \phi_1\tau_1) + \tau_2[-\phi_1 - \phi_f(1 - \phi_1\tau_1)]\}\right].$$
$$d' = BFD - f_F = (t_{XP} + z') - 1/\phi$$

The objective lens is the stop and they share the size.

$$D_{EP} = D_1$$

For nonvignetting,

$$a_2 \geq |y| + |\bar{y}| = a_{EP}\left[|0.1\tau_1 + \tau_2(0.1 - 0.1\phi_f\tau_1)| + |(1 - \phi_1\tau_1) + \tau_2[-\phi_1 - \phi_f(1 - \phi_1\tau_1)]|\right].$$

For $t = f_1 + f_2$, we have the following reduced equations:

$$MP = \frac{1}{m} = -\frac{f_1}{f_2}$$
$$ER = (1 - m)f_2$$
$$D_{XP} = |m|D_{EP}$$
$$d' = -\frac{f_2^2}{f_f}$$

The notation for binocular is AXB, with $A = |MP|$ and $B =$objective diameter in mm.