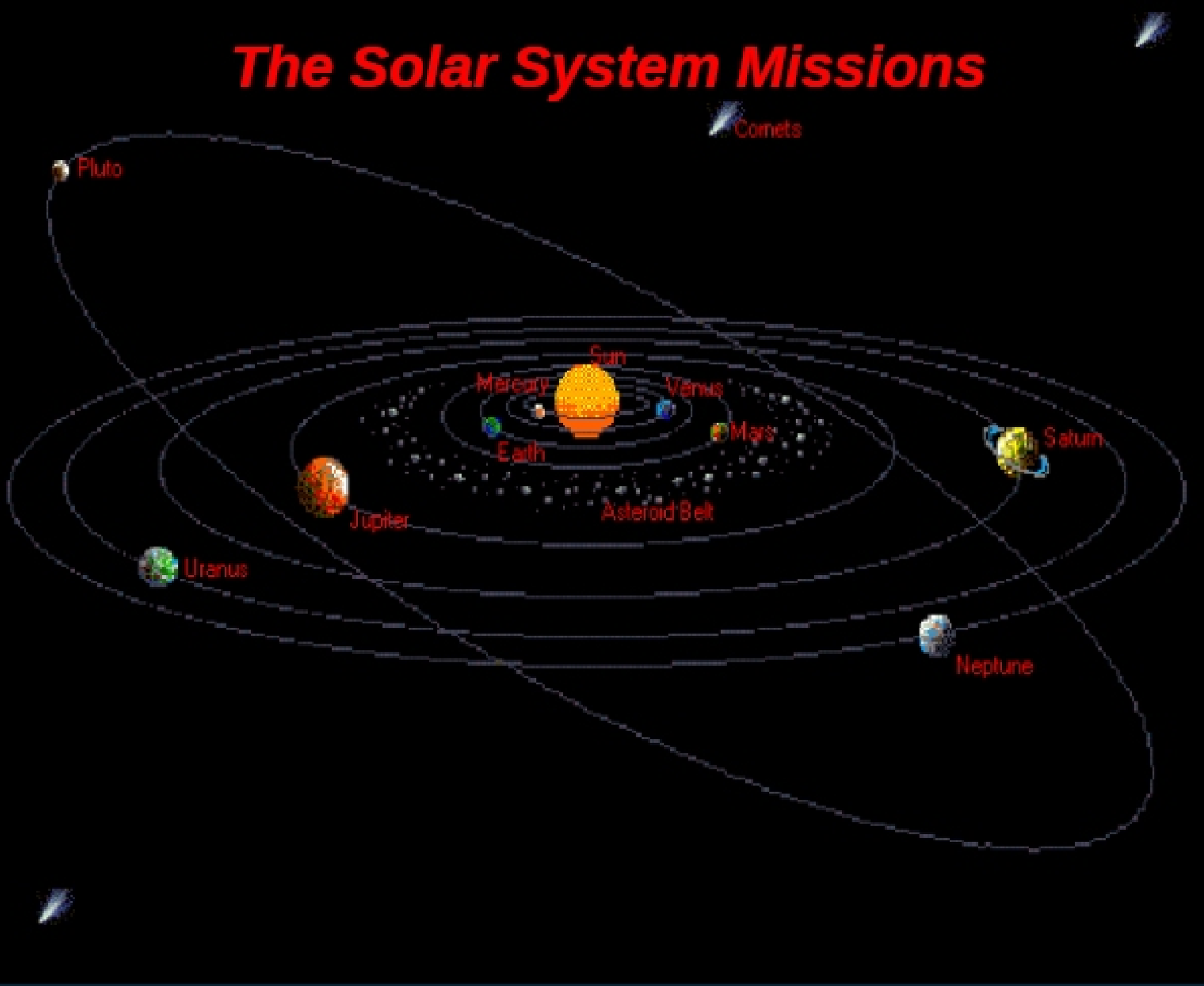
The Solar System Missions



Exposure times

Light from a source is collected by a 6 inch telescope by a high school science class. Rather than using an eyepiece, the image is recorded by a camera on film. Since the source is fairly dim, a 30 minute time exposure is required to adequately record the image. If the same source is observed with the 200 inch Mt. Palomar telescope, what exposure time will be requried to produce the same photo, assuming all else is equal?

Exposure time is determined by the number of photons collected.

Best guess – exposure time α $1/ d^2$

Number of photons α d^2

Therefore, (exposure time 1) $(d1^2)$ = (exposure time 2) $(d2^2)$

Exposure time 2 = $(d1/d2)^2$ (exposure time 1) = 0.027 min = 1.62 sec.

planets not shown to scale >>									
	Mercury	Venus	Earth	Mars	Jupiter	Saturn	Uranus	Neptune	Pluto
Mean Distance from the Sun (AU)	0.3871	0.7233	1	1.524	5.203	9.539	19.19	30.06	39.48
Sidereal period of orbit (years)	0.24	0.62	1	1.88	11.86	29.46	84.01	164.79	248.54
Mean Orbital Velocity (km/sec)	47.89	35.04	29.79	24.14	13.06	9.64	6.81	5.43	4.74
Orbital Eccentricity	0.206	0.007	0.017	0.093	0.048	0.056	0.046	0.010	0.248
Inclination to ecliptic (degrees)	7.00	3.40	0	1.85	1.30	2.49	0.77	1.77	17.15
Equatorial Radius (km)	2439	6052	6378	3397	71490	60268	25559	25269	1160
Polar Radius (km)	same	same	6357	3380	66854	54360	24973	24340	same
Mass of planet (Earth=1)	0.06	0.82	1	0.11	317.89	95.18	14.53	17.14	0.002
Mean density (grams/centimeter^3)	5.43	5.25	5.52	3.95	1.33	0.69	1.29	1.64	2.03
Body rotation period (hours)	1408	5832	23.93	24.62	9.92	10.66	17.24	16.11	153.3
Tilt of equator to orbit (degrees)	2	177.3	23.45	25.19	3.12	26.73	97.86	29.6	122.46
Number of observed satellites	0	0	1	2	>28	30	24	8	1