

Horsehead Nebula

1375 ± 54 ly



Horsehead Nebula

1375 \pm 54 ly



Clusters Clustered Around the Milky Way



M13

Great Globular Cluster in Hercules

22,200 ly



M15

35,700 ly



Galaxies Beyond Our Milky Way



M82 and M81



Distance: 11.7 million light-years



Whirlpool Galaxy

May 9, 2005



Whirlpool Galaxy — Supernova 2005cs

July 10, 2005



Whirlpool Galaxy — Supernova 2011dh

June 6, 2011



Whirlpool Galaxy

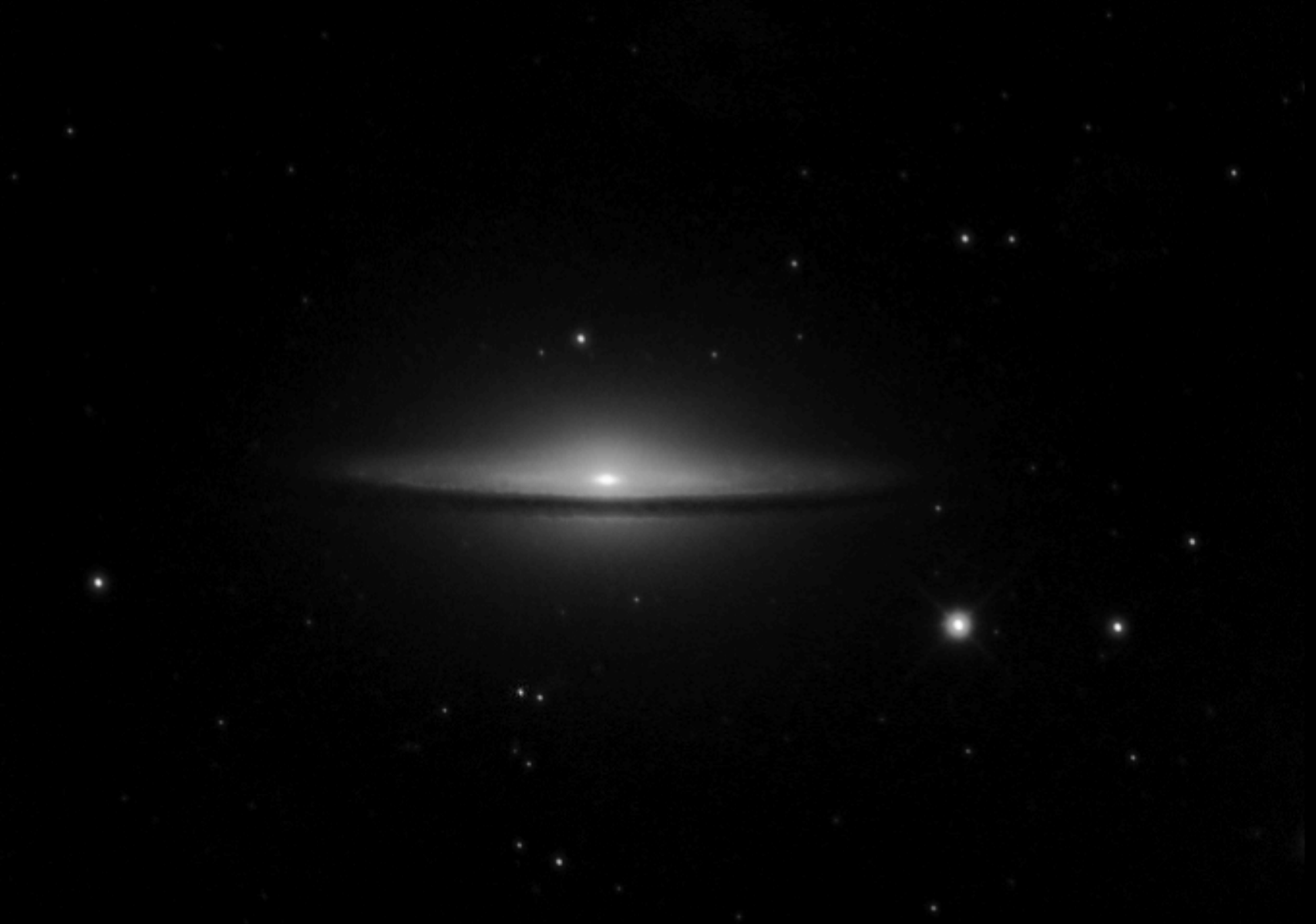
May 9, 2005



Sombrero Galaxy (M104) 31,000,000 ly



Sombrero Galaxy (M104) and Asteroid Renauxa



Needle Galaxy (NGC 4565) 43 ± 1 million ly



Deerlick Galaxy Cluster 40 ± 3 million ly



Why Astrophotography?

Long Exposures, Permanent Record, Digital Enhancement, Light Pollution!



Visual Experience



Long Exposure



Light Pollution Subtracted



Old Astronomical CCD camera

- ▶ StarlightXpress SXV-H9
- ▶ Pixel size: 6.45×6.45 microns
- ▶ Pixels: 1392×1040
- ▶ Quant. Eff.: $\sim 65\%$
- ▶ Readout Noise: ~ 7 electrons
- ▶ Cooling: $\sim 30^\circ\text{C}$ below ambient
- ▶ Download: 3.5 seconds
- ▶ Weight: 350g



New Astronomical CMOS camera

- ▶ ZWO ASI2400MC-Pro
- ▶ Pixel size: 5.94×5.94 microns
- ▶ Pixels: 6072×4042
- ▶ Quant. Eff.: $\sim 80\%$
- ▶ Readout Noise: ~ 1.1 electrons
- ▶ Cooling: $\sim 35^{\circ}\text{C}$ below ambient
- ▶ Download: 0.125 seconds
- ▶ Weight: 1360g

