

# Astrophotographs

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# Most Pics Were Taken From My Driveway





# M1 – Crab Nebula



# M13 – Great Globular Cluster in Hercules



# M16 – The Eagle Nebula (aka Pillars of Creation)



# M27 – Dumbbell Nebula



# M31 – The Andromeda Galaxy



# M42 – Great Orion Nebula



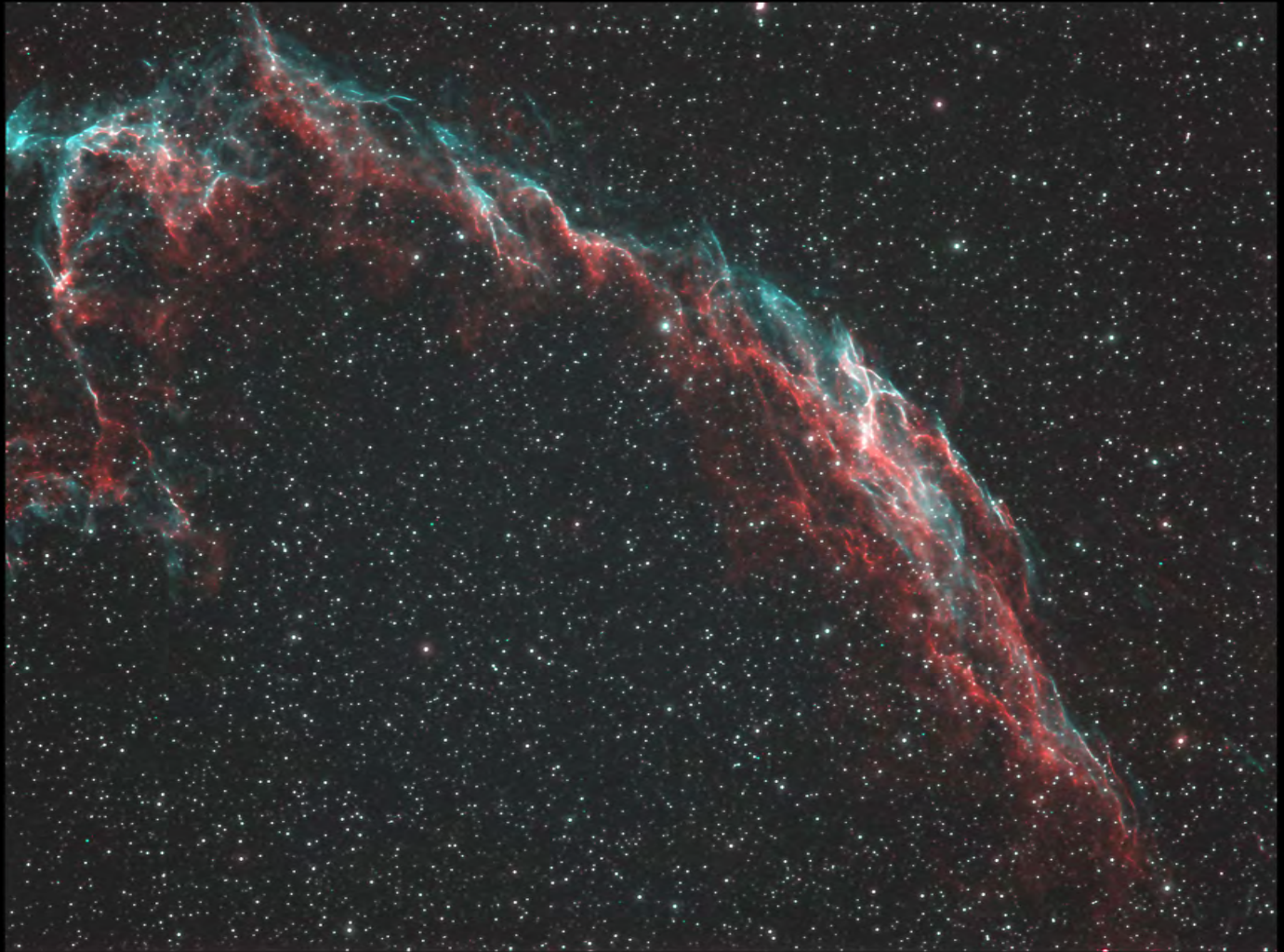
# M45 – Pleiades (aka Subaru)



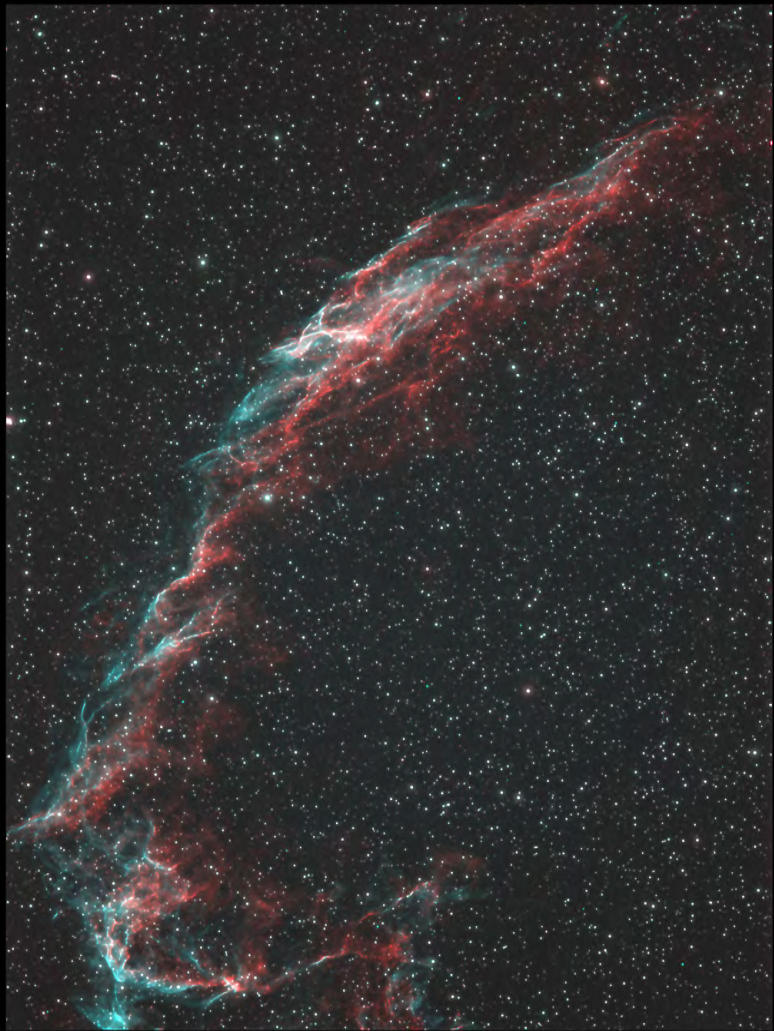
# Western Veil Nebula



# Eastern Veil Nebula



# Veil Nebula



# Bubble Nebula



# Helix Nebula



# Elephant Trunk



# IC434 – The Horsehead Nebula



# Running Man Nebula



# Rosette Nebula



# Rosette Nebula



# Pelican Nebula



Thank You



Questions?

# A Little About Me

- Born/Raised: Grand Rapids, MI
- Undergrad: Chemistry, 1976, Rensselaer Polytechnic Institute (RPI)
- Grad: Applied Math, 1981, Cornell
- Postdocs:
  - NSF Fellow, Math, NYU
  - Visiting Lecturer, Math, Univ. of Illinois Urbana/Champaign
- Industry:
  - AT&T Bell Labs, Math Research Center
- Academia: Princeton, 1990-present
- Hobbies/Passions:
  - Soaring
  - Tennis
  - Astronomy
  - Photography
  - Math/Computation
  - Local Warming, Purple America, etc.

# M1 – Crab Nebula

- *What:* Supernova remnant
  - *When:* Oct. 27, 2006
  - *Where:* Driveway
  - *Telescope:* 10" Ritchey-Chretien
  - *Camera:* Starlight Xpress SXV-H9
  - *Exposure:* Luminance=60min, H $\alpha$ =140min, O-III=20min
  - *Sub-Exposures:* 20-minutes, guided
- 
- *Distance:* 6500  $\pm$  1600 lightyears
  - *Diameter:* 11 lightyears

# M13 – Great Globular Cluster in Hercules

- *What:* Gravitationally bound cluster of stars
  - *When:* Oct. 27, 2006
  - *Where:* Driveway
  - *Telescope:* 10" Ritchey-Chretien
  - *Camera:* Starlight Xpress Trius SX-694
  - *Exposure:* Luminance=6min, Red=8min, Green=6min, Blue=6min
  - *Sub-Exposures:* 20-second, unguided
- 
- *Distance:* 22,000 lightyears
  - *Diameter:* 168 lightyears

# M16 – The Eagle Nebula (aka Pillars of Creation)

- *What:* Young star cluster and diffuse emission nebula
  - *When:* June 26 2005, July 17 2006, July 8 2007
  - *Where:* Driveway
  - *Telescope:* 10" Ritchey-Chretien
  - *Camera:* Starlight Xpress SXV-H9
  - *Exposure:* H $\alpha$ =266min, O-III=66min
  - *Sub-Exposures:* 4-minute, 6-minute, 10-minute, guided
- 
- *Distance:* 5,700  $\pm$  400 lightyears
  - *Pillar Height:* 9.5 lightyears

# M27 – Dumbbell Nebula

- *What:* Planetary nebula
  - *When:* Aug. 6, 2016
  - *Where:* Driveway
  - *Telescope:* 10" Ritchey-Chretien
  - *Camera:* Starlight Xpress Trius SX-694
  - *Exposure:* H $\alpha$ =90min, O-III=80min
  - *Sub-Exposures:* 10-minute, guided
- 
- *Distance:* 1360  $\pm$  200 lightyears
  - *Diameter:* 1.4 lightyears

# M31 – The Andromeda Galaxy

- *What:* Nearby galaxy
  - *When:* Oct. 26, 2008
  - *Where:* Driveway
  - *Telescope:* 4" Takahashi FSQ refractor
  - *Camera:* Starlight Xpress SXV-H9
  - *Exposure:* Luminance=80min, Red=40min, Green=40min, Blue=40min
  - *Sub-Exposures:* 2-minute, unguided
- 
- *Distance:* 2,500,000 lightyears
  - *Diameter:* 220,000 lightyears

# M42 – Great Orion Nebula

- *What:* Young star cluster and diffuse emission nebula
  - *When:* Nov. 25, 2006
  - *Where:* Driveway
  - *Telescope:* 10" Ritchey-Chretien
  - *Camera:* Starlight Xpress SXV-H9
  - *Exposure:* H $\alpha$ =32min, O-III=35min
  - *Sub-Exposures:* 1-minute, guided
- 
- *Distance:* 1,344  $\pm$  20 lightyears
  - *Diameter:* 24 lightyears

# M45 – Pleiades (aka Subaru)

- *What:* Open star cluster
  - *When:* Jan. 3, 2008
  - *Where:* Driveway
  - *Telescope:* 4" Takahashi FSQ refractor
  - *Camera:* Starlight Xpress SXV-H9
  - *Exposure:* Red=16min, Green=20min, Blue=122min
  - *Sub-Exposures:* 2-minute, unguided
- 
- *Distance:* 444 lightyears

# Veil Nebula

- *What:* Supernova remnant
  - *When:* July 25 2008, July 24 2008
  - *Where:* Driveway
  - *Telescope:* 4" Takahashi FSQ refractor
  - *Camera:* Starlight Xpress SXV-H9
  - *Exposure:* H $\alpha$ =60min, O-III=60min. *Exposure:* H $\alpha$ =52min, O-III=24min
  - *Sub-Exposures:* 2-minute, 4-minute, unguided
- 
- *Distance:* 1470 lightyears
  - *Diameter:* 70 lightyears

# Bubble Nebula

- *What:* Emission nebula w/ stellar wind
  - *When:* Oct. 21 2006, Sept. 7 2016
  - *Where:* Driveway
  - *Telescope:* 10" Ritchey-Chretien
  - *Camera:* Starlight Xpress SXV-H9 and Trius SX-694
  - *Exposure:* H $\alpha$ =350min, O-III=230min
  - *Sub-Exposures:* 10-minute, 20-minute, guided
- 
- *Distance:* 9, 100  $\pm$  2000 lightyears
  - *Diameter:* 8  $\pm$  2 lightyears

# Helix Nebula

- *What:* Planetary nebula
  - *When:* Oct. 2, 2008
  - *Where:* Driveway
  - *Telescope:* 4" Takahashi FSQ
  - *Camera:* Starlight Xpress SXV-H9
  - *Exposure:* H $\alpha$ =86min, O-III=54min
  - *Sub-Exposures:* 2-minute, guided
- 
- *Distance:*  $714 \pm 70$  lightyears
  - *Diameter:* 5.7 lightyears

# Elephant Trunk

- *What:* Star birth area in interstellar medium
  - *When:* Aug. 29, 2016
  - *Where:* Driveway
  - *Telescope:* 10" Ritchey-Chretien
  - *Camera:* Starlight Xpress Trius SX-694
  - *Exposure:*  $H\alpha=156\text{min}$
  - *Sub-Exposures:* 6-minute, guided
- 
- *Distance:* 22,000 lightyears
  - *Diameter:* 168 lightyears

# IC434 – The Horsehead Nebula

- *What:* Dark nebula (dust cloud)
  - *When:* Oct. 8, 2004
  - *Where:* Driveway
  - *Telescope:* 4" Takahashi FSQ refractor
  - *Camera:* Starlight Xpress SXV-H9
  - *Exposure:* H $\alpha$ =116min, G=18min, B=18min
  - *Sub-Exposures:* 2-minute, unguided
- 
- *Distance:* 1,400 lightyears

# Running Man Nebula

- *What:* Bright reflection nebula
  - *When:* Jan. 28, 2008
  - *Where:* Driveway
  - *Telescope:* 4" Takahashi FSQ refractor
  - *Camera:* Starlight Xpress SXV-H9
  - *Exposure:* Red=24min, Blue=100min
  - *Sub-Exposures:* 2-minute, unguided
- 
- *Distance:* 1,500 lightyears
  - *Diameter:* 15 lightyears