

Clearing skies allowed a variety of imaging.

Solar System: Clif Ashcraft imaged Jupiter and Saturn with its rings and found that under poor conditions shorter exposures are sharpest.

His image of the young moon showed Mare Crisium and the wedge from crater Proclus sharply. His image of the gibbous moon showed the *dark Crater Plato and the dark chevron shape* just west (left) of the crater. Its upper part is caused by dark mare plateau material, and the right-hand part is caused by an outline by a light-colored ray.



Nebulae: Isbel Gonzalez imaged M57 with the 26" telescope at NJAA in Vorhees State Park.

Clif imaged M42 in Orion in the morning. It's good to see an old friend return.

Galaxies: In Pegasus Helder Jacinto imaged spiral galaxies in the *Deer Lick Group (NGC 7331)* and Stephan's Quintet (NGC 7317), each for five hours. The prominent spiral galaxy in the Deer Lick group is sometimes referred to as the twin of the Milky Way, but does not have a small central bar as our galaxy does. Édouard Stephan discovered his quintet at the Marseille Observatory in France in 1877. Four tiny galaxies are part of Hickson Compact Group 92 and are roughly 300 million lightyears from us. They will probably merge into a giant galaxy like M87 someday. Its fifth galaxy is in the foreground also.



Presentations: Al Witzgall spoke on "The Tale of Two Meteorites: An Untold Story of Apollo" at NWJAA on September 27.

Other: Clif pointed out that WFIRST (Wide-Field Infrared Survey Telescope) will get a composite coronagraph with both deformable mirrors and a mask to blot out the light from a star in order to be able to see its exoplanets and asteroid disks. The "starglasses" instrument is now being tested at JPL in Pasadena, and is expected to be launched within six years. In January 2017 Bob Vanderbei spoke to AAI about the design of these masks.

Steve Lowe pointed out that the transit spectrum of Earth has been measured from the SCISAT satellite. In the near-infrared the upcoming James Webb Space Telescope could detect CO₂ and H₂O in a bright

exoplanet. A mid-IR campaign would be more challenging, but in principle could detect the biosignatures O₃ and CH₄.

Comet C/2019 Q4 Borisov is the second comet with a well-established hyperbolic orbit (after Oumuamua in October 2017). As such, it is an interstellar visitor with orbital eccentricity 3.08 (well above 1.0). It is coming in from above the plane of the solar system and is expected to brighten from 18th magnitude. The fuzzy comet's current velocity is about 93,000 mph, certainly high enough to escape from the solar system. We will see it only for a few months ever.

John Kozimbo pointed out that the U.S. Mint is issuing another \$1 coin with an astronomy theme. This coin features Annie Jump Cannon who first classified the stars by their spectra. She invented the spectral classes we use today, OBAFGKM.

Respectfully submitted, Mary Lou West, Research Chair

