

### Offered Title: 48 Eyes on the Sky

I thought I and my club buddies liked to spot little dim nebulous objects and exclaim...yes, there it is! In reality most of the objects we look at are relatively bright. So, what gives?

The dimness of an object is relative to its inherent brightness, size, and distance from us. Oh yeah, I forgot, for an observer it also depends on the size of your telescope or binoculars. Bigger instrument, brighter view. My little 4" refractor shows most bright nebula and galaxies as pretty dim. The same objects in a 10" scope is significantly brighter. A 20" scope, wow!

Another important factor playing into the dim/bright characteristic is called f-ratio or speed of the instrument. I'm not going into technical aspects of it but remember this, the smaller the f-number, the faster the optical system. Faster means collecting more light per inch of aperture and that means brighter.

So, two astronomy profs are sitting in a bar, sipping craft beer and carping about lazy graduate students. OK, they were in a restaurant and concerned that research projects are too expensive and take too long just to get infrastructure in place. By the time the infrastructure is done they have seen numerous graduate students come and go. They need a project that can be quickly set up and not cost \$10 million or more. What to do?

The profs, Pieter van Dokkum (Yale) and Roberto Abraham (U of Toronto) had been discussing ways to image extremely dim debris that theoretically surrounds galaxies. Big instruments are very, very expensive to use for this search. Van Dokkum suggested the possibility of using a newly introduced version of the very fast Canon 400mm f/2.8 telephoto lens, coupled to a CCD camera. This lens has special coatings that could be ideal for their purpose. They decide to jump in, with one lens.

Voila! They were able to image the known stuff around M51/NGC5195. Then they thought hey, if one lens can get this stuff, three lenses might do better! They were right. The project snowballed as more and more lenses/cameras were added. Next thing you know they have 24, that's right, 24 of these lens/camera combos each in a supporting cage and all physically joined, in a big hexagonal shape. The entire array of 24 lenses is supported by a hefty, computer-controlled mount. Each lens images the same object separately and all the imaging data is combined to improve sensitivity. Currently they have two of these 24 lens arrays set up, totaling, you guessed it, 48 eyes on the sky. They call it Dragonfly.

To date Dragonfly has discovered many dim, diffuse galaxies, dwarf galaxies, globular clusters, and has provided important data to teams searching for dark matter. All this with camera lenses. Dragonfly's 24 lens array f-ratio? F/0.39! Now that is fast.

### What's in the Sky?

May 12; evening; south-high: The waxing Moon and Regulus (Alpha Leonis) share the sky