

71.05

Sub-Arcsecond Resolution 2 μ m Imaging of W51

J. D. Goldader and C. G. Wynn-Williams (U. Hawaii)

We report results of our JHK imaging observations of the highly luminous obscured H II region W51 using a 256 x 256 NICMOS array. To first order, we find excellent agreement between the morphologies of the extended emission at 6 cm and 2 μ m. W51 IRS2 is resolved into a dense, compact cluster of at least 40 stars surrounded by an envelope of extended emission 40" in diameter.

Comparison of narrow-band Brackett- γ filter and K-band images indicates that the extended continuum emission visible across our 1.5 x 1.5 arcminute field is dominated by a combination of free-free and bound-free emission from ionized hydrogen and helium, without any contribution necessary from PAH or any other kind of heated dust grains. Comparison of our K-band images to 6 cm continuum radio maps shows the extinction to W51 to be quite uniform across the source, and about the value one would expect for normal galactic extinction. This leads us to suspect that the ionized gas associated with IRS 1 and IRS 2 is in front of the W51 molecular cloud. We do note, however, the presence of several narrow obscuring dust lanes which seem to correspond to absorption features seen in 6 cm H₂CO maps by Kogut et al. 1989.

We have separated the field stars from those probably associated with W51 on the basis of H-K colors, and have tentatively identified the stars providing the ionizing flux for the HII region. A small number of very luminous stars appear sufficient to provide the bulk of the luminosity for both IRS 1 and IRS 2. Finally, several very red objects have been detected that appear to be associated with W51. One new object, with H-K > 6, is not associated with any masers or compact radio sources. Another may be associated with the 8 μ m and 20 μ m sources seen in IRS 2 by Genzel et al. 1982, and is only a few arcseconds from the copious masers in that region.

71.06

The Resolution Limits of Large Ground-Based Telescopes

T. S. McKechnie (Lentec Corp)

It has been predicted that large (5 meter) ground-based telescopes should routinely be able to achieve 0.05 - 0.1 arc second resolution at near-infrared wavelengths using direct imaging techniques. This prediction has now been confirmed by experiments in which 0.07 - 0.1 arc second resolution has been achieved at 2.2 micrometer during 1 arc second seeing conditions in the visible. With the 8 and 10 meter telescopes now under construction or at the planning stages even higher levels of resolution are predicted. These very high levels of resolution are at odds with conventional theory which predicts only marginal resolution improvement at infrared wavelengths. Conventional theory is based on the assumption that the outer scale of turbulence L_0 is much larger than the largest telescopes, with estimates ranging from tens of meters to many kilometers. However, much of the large scale turbulence attributed to the atmosphere is in fact simply the result of telescope oscillations and tracking errors. The new predictions are based on a much smaller measured value of L_0 , in the range 20 - 40 cm.

71.07

Optical Gyroscopes Applied to Telescopes

H. W. Babcock (OCIW)

Optical gyroscopes mounted directly on a telescope can provide its precise angular coordinates referred to the fundamental inertial system. Tracking of a star can be accomplished by computing continually in real time its changing apparent place, and by applying computer-generated corrections to the telescope to maintain coincidence between the output of the gyros and the apparent place of the star. This system circumvents mechanical imperfections of the telescope's mounting and drives, thereby promising significant cost reduction.

71.08

Modelling the HST Point Spread Function

C.J. Burrows (ESA/STScI) and H. Hasan (STScI)

The images produced by the Hubble Space Telescope are now well understood. An extensive telescope imaging simulation has been prepared, which when used with parameters derived from on-orbit imagery is able to quantitatively model the point spread function (PSF). The model includes not only the spherical aberration, but also numerous other effects on the image such as additional aberrations in the cameras, the obscurations in the telescope pupil, optical misalignments, Gaussian distributed pointing errors, dust and mirror micro-roughness. It is able to predict in some detail the observed variations with field position and wavelength of the PSF. It allows simulation of complex fields, and photometric or morphological investigations to be modelled in detail. In addition, we quantify the effects of low frequency ripple measured in full aperture interferograms on the primary and secondary mirrors, measured spacecraft jitter data, and observed ghosts and bignetting in the cameras. These effects are being incorporated as part of the ongoing simulation development effort. A library of simulated PSFs for images of stars as viewed through different filters by the Wide Field and Planetary Cameras and the Faint Object Camera is being maintained.

71.09

A Bayesian Period Search Method

P.C. Gregory (UBC), T.J. Loredo (Cornell)

The problem we address is the detection of a periodic signal when we have no prior information about the signal's shape. Usually an experimenter has some reason to suspect the presence of a periodic signal but in other cases the search for a periodicity represents an unexplored avenue with important consequences if successful, SETI being one example of the latter. Given some data we seek the optimum approach to answering the question, 'Is there a periodic signal present and what is the best estimate of its period and shape?' In this paper we present a Bayesian solution to the problem in the case where the data consists of event arrival times. The results are thus directly applicable to counting experiments where the Poisson distribution is the appropriate sampling distribution. The method will be illustrated using x-ray astronomy pulsar data.