utilizes the Gull-Skilling (1989) MEMSYS-3 package of routines for maximum entropy (MaxEnt) reconstruction of arbitrary sets of data. The new MEMSYS-3 code, and our extensions to it, represent a significant improvement over previous MaxEnt implementations (Weir and Djorgovski, 1991).

A recent application of this system includes restorations of ESO images of the mysterious object R136 in the core of the 30 Doradus nebula (Weir et al., 1991). An especially useful feature of this software is that it allows one to solve for a restored image at subpixel spatial scales, if the S/N is high enough. This ability facilitates the detection of very high resolution structure in the restored image which otherwise might not be apparent due to the large pixel size of the original data. From simulated images and double blind tests, we have never found the method to introduce structure at subpixel scales when it did not actually exist. To restore to such levels, one must be able to adequately interpolate the point spread function (PSF) at the subpixel level. We typically use a PSF determined by the stellar photometry programme Daophot, which achieves a three times higher than nominal sampling estimate of the PSF by forming a composite of stars from the image of interest.

The pictures in Figure 1 are of images obtained (a) on the ESO 2.2-m telescope in ~ 1.2 arcsec seeing, (b) its restoration, (c) an image obtained on the NTT in ~ 0.5 arcsec seeing, and (d) its restoration. This data set provides an excellent means of assessing the power and validity of our deconvolution method by providing us with an estimate of "the truth" (the NTT image) by which to judge the restoration of the poorer quality data (a). We were pleased to find very high correspondence. Virtually all of the maxima in restoration (b), even those which may appear on the surface to be ringing artifacts or noise, actually have counterparts in the independently derived image (c). The faint fuzzy or filamentary structures in (b) are typically how the algorithm represents two or more fainter point sources which it is unable to clearly resolve in the original data. We can thus reliably detect stars at least a magnitude fainter than was possible in the unprocessed data.

From our determination of the power and accuracy of the first restoration, we are able to estimate the degree of resolution and reliability in the deconvolution of the NTT data. We estimate that we are able to reliably distinguish and resolve binaries of equal intensity down to the separations of *0.2 arcsec* or lower throughout the image. The oblong nature of some of the objects in (d) indicates that we are beginning to reach some fundamental limits in resolution, probably due to our inability to form a precise enough estimate of the PSF for all parts of the image. The PSF has been determined in the outer parts of the $2\farcm5 \times 2\farcm5$ image where the crowding is still quite severe, and the profile of the brightest and most isolated stars can still be contaminated by faint objects. Nonetheless, virtually all of the maxima detected in (d) are easily identifiable (with the proper stretch) in image (c). The principal benefit of deconvolution is in deblending the most crowded groups, to gain a better indication of the number and location of objects in the image.

The next step in our analysis is to construct colour-magnitude diagrams in the cluster centre region, and compare them with those at larger radii. The photometric results of MaxEnt restorations have long been known to be biased in the downward direction. We have found that this degree of bias can be reasonably modeled through Monte Carlo simulations, providing the possibility of statistically correcting for this effect in the image. We prefer, however, the following approach. Given that MaxEnt does an excellent job of object detection and separation, we use the restored image as a high-resolution "finding chart" by which to locate and obtain first estimates of the position and flux of all objects in the image. Next, one feeds these estimates into a least squares PSF fitting package, e.g., Daophot or Romaphot, to obtain unbiased stellar photometry from the original lower resolution images. We have only begun to experiment with this hybrid approach, but the results appear quite promising.

While we will not be able to achieve the resolution possible with speckle methods for bright objects, we do not think we have yet reached the maximum possible resolution attainable via direct imaging and subsequent deconvolution: in fact we are still largely limited by pixel size. Because of the large field of view and long integrations possible with direct imaging, we believe that sophisticated new restoration methods have real promise for providing resolution and depth previously thought achievable only from outside the earth's atmosphere, perhaps at the level of 0.1 arcsec for a broad range of objects.

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IAU Working Group on Photography Meets at ESO

On October 29–30, 1990, the IAU Working Group on Photography (within IAU Commission 9: Instruments) met at the ESO Headquarters in Garching. It was the second time a meeting of this group took place at ESO; last time was in 1978 while the ESO Telescope Division was still located at CERN.

Much has happened within the field of astronomical photography during the past 12 years. CCDs have taken over at many telescopes and to some it may perhaps appear that photography is on its way out of astronomy. However, this is certainly not yet true. Photography is still unequalled when wide fields are observed at high spatial resolution, i.e. whenever areas covering more than a few thousand pixels square are involved. Moreover, the ease of storage and data retrieval from photographical plates should not be underestimated, while the possibility of future digitalization of sky surveys (to provide easy computer access to the information) is a most interesting development. It should of course also be kept in mind that not all observatories have the necessary means to acquire state-of-the-art CCDs. For them, photographic observations will still continue to be an important activity for quite some time to come.

The 1990 WG meeting, which was moved from Nice to Garching at the last moment for technical reasons, attracted about 40 specialists, mainly from Europe and including a substantial complement from Eastern Europe. The discussions centred on a variety of subjects, in particular the extraction of information from photographical plates. There has been important progress in the accuracy and speed of microdensitometry, and image "manipulation" in the photographic laboratory allows us to see weak and/or extended structures which would otherwise not be visible.

The big Schmidt telescopes in the world continue their surveys of the northern and southern skies which will provide present and, not the least, future generations of astronomers with the possibility to learn about the past behaviour of objects with newly discovered, peculiar properties. Several "durchmusterung"-type projects are based on these surveys and provide extensive lists of selected objects for detailed studies with larger telescopes.

The Organizing Committee of the Working Group decided to study how this group can best be continued; photographic methods alone may become too narrow a delimitation in the future. The WG will meet again at the IAU General Assembly in Buenos Aires next year and expects to take the corresponding decision there.

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Lithium in Chromospherically Active Stars

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1. Introduction

The abundance of Lithium in stars is perhaps one of the least understood problems in Astrophysics. Contrary to most other elements, Li is not produced in the standard way by stellar nucleosynthesis; rather, it is believed to have largely been created at the very beginning of the Universe. An accurate measure of the present Li abundance can thus provide stringent constraints on models of the Big Bang. Unfortunately, Li is a very fragile element and its isotopes Li^6 and Li^7 are destroyed by nuclear reactions at temperatures higher than 2.2×10^6K and 2.6×10^6K, respectively. Since most of the stellar interiors are at temperatures higher than this, Li is confined to shallow surface layers. It is not surprising that a number of mechanisms exist to mix the surface Li to the hotter interior, thus changing the present abundance of Li with respect to the primordial value. To make things even worse, there are also a number of mechanisms (nuclear spallation reactions by cosmic rays, production in novae and in red giants) that can potentially increase the abundance of Li on time scales comparable to the age of the Galaxy. For all these reasons, it is extremely important to understand the mechanisms that lead to Li depletion in stars or to a possible Li enrichment of the interstellar medium during the galactic evolution.

The "classical" picture of Li depletion in late-type stars was put forward by Herbig in the mid-sixties (see Herbig, 1965). He noticed that field stars of spectral type F8 to G5 present a very large spread in the Li abundance (more than two orders of magnitude) and that the largest Li abundances were ≈ 3.0 (these are logarithmic values on a scale where $\log n(H) = 12.0$). These values were similar to those found in T-Tauri stars and in meteorites. Herbig also found that Li depletion increases towards later spectral types. It is very rare to find large Li abundances in stars later than G5. Typically, K stars do not show a measurable Li line.

The easiest way to interpret these observations was to suppose that all stars (at least those of Population I, see later) were born with the same Li abundance and that Li was progressively depleted in late-type stars under the action of convective motions that bring surface material down to deeper layers. Li is more rapidly depleted in cooler stars which have deeper convective zones and hence higher temperatures at their base. Herbig's interpretation is at the origin of the well-known use of the Li line as an age indicator for solar-type stars, a notion that has commonly been accepted for nearly two decades. There were however a number of "disturbing" effects that, although usually neglected, should have cast doubts on the simplified classical picture. For instance, a substantial number of early F stars were known to have a low Li abundance, much lower than the initial value of about 3.0. Since these stars have very shallow convective zones, it is not clear how they could have been deprived of their Li. Moreover, if Li abundance in solar-type stars were related to age, one should observe a tight correlation between Li abundance and other indicators of age, such as surface rotation or chromospheric Ca II H and K emission. This is typically not observed.

There were also problems on the theoretical side. Standard models of the interior structure of stars show that the bottom of the convective zone in solar-type stars has a temperature significantly lower ($\approx 2.0 \times 10^6$K) than the minimum temperature needed to destroy Li^7 by nuclear reactions ($\approx 2.6 \times 10^6$K). Since the lithium we observe is mostly Li^7, some mechanism other than simple convective transport is required to provide for its depletion. The larger convective zones of K stars are expected to penetrate deep enough to allow nuclear burning of Li, but in the Sun, and in general in all late F and G dwarfs, some extra mixing is definitely required. Several possibilities have been suggested: *turbulent diffusion* below the convective envelope driven by convective overshoot, *mixing* induced by radial differential rotation, *"evaporation"* of Li-rich surface layers through stellar winds, and others.

Over the past decade great advances have been made in the study of Li abundance in stars. In particular, new high-quality observations of open clusters (for a review, see Boesgaard, 1990) have revealed the existence of a "dip" at ≈ 6650 K in the Li abundance of all clusters with ages greater than $\approx 10^8$ years. In the dip, the Li abundance is reduced by at least two orders of magnitudes, while it is "normal" both a temperatures higher than ≈ 6900 K and in the temperature range 6300–6100 K (while decreasing sharply at still lower temperatures). The dip has also been identified in observations of F stars in the field. The reasons for this peculiar