to UNIX. The values for the VAX 8600 are given for comparison and were also obtained with a single user on the system.

## 5. Discussion

The results in Table 2 reflect the behaviour of the systems in three different aspects: Process scheduling in the first column, I/O bandwidth as scaling operation in the second column and floating point performance in the third column. The table operations included in the fourth column give an indication of both I/O bandwidth and floating point performances.

The times for process scheduling show a surprising spread with almost a factor of 10 between the fastest and slowest system. There is little correlation between the speed of starting a new task and general CPU performance. The Aegis and VMS operating systems have a significant lower performance than typical UNIX systems. This is especially odd in the case of VMS, since MIDAS executes application tasks differently for VMS and UNIX machines: In UNIX machines a child process is started and the task executed in the context of that subprocess. In VMS a subprocess is created only once, then, the applications are executed in the context of that subprocess. Therefore, the measured time for VMS is just the time for running an executable task in an existing subprocess, not for creating a child process as well.

The I/O bandwidth indicated by the scaling task depends on three major factors namely: physical speed of disk drive and interface, block size of the file system and implementation of hashing techniques. Due to the two latter factors, most BSD UNIX systems have at present a higher disk I/O performance than those based on SYS V. One of the exceptions is the Bull SPS9 system based on SYS V but using a very efficient disk controller. The SUN 3-4/260, VAX 8600, PCS and SPS9 used SMD type controllers with 8 inch disks which give higher performance than the SCSI or ESDI interfaces available on most other systems.

TABLE 2: *Benchmark results in seconds elapsed time.*

| Vendor-Model | Schedule | Scaling | Median | Table | Remarks |
|---|---|---|---|---|---|
| HP 9000-835 | 33 | 13 | 33 | 34 | |
| HP 9000-350 | – | 39 | 118 | – | Software FP |
| Apollo DN 4000 | 167 | 14 | – | 47 | |
| Apollo DN 590 | 142 | 13 | – | 50 | |
| SUN 4/110 | 25 | 7 | 61 | 30 | |
| SUN 4/260 | 30 | 8 | 41 | 22 | |
| SUN 3/60 | 46 | 27 | 124 | 90 | Software FP |
| Bull SPS 9/830 | 24 | 7 | – | 17 | |
| Tektronix TEK 4301 | 97 | 15 | – | 46 | |
| Matra MS 1326 | 40 | 11 | – | 32 | SUN 3/260 |
| Matra MS 1306 | 39 | 16 | – | 63 | SUN 3/60 |
| Masscomp MC-5450 | 73 | 20 | – | 79 | Standard file system |
| Prime PXCL 5500 | 31 | 17 | 58 | – | |
| DEC μ VAX II | 115 | 30 | 157 | 89 | |
| DEC VAX 8600 | 167 | 10 | 30 | 37 | |
| DEC VAX 3500 | 38 | 11 | 51 | 44 | |
| PCS Cadmus 9900 | 130 | 34 | 109 | – | |
| PCS Cadmus 9933/RC | 17 | 13 | 27 | 37 | |
| Nixdorf Targon 35 | 39 | 10 | 45 | 15 | |

The single precision floating point performance is given by the median filter. It is interesting to see how the performance of relatively cheap work-stations slowly approaches that of machines like the VAX 8600. One may even argue that some work-stations have too high CPU performance compared to their I/O bandwidth when used for interactive image processing. The RISC machines usually have a much higher rate of executing instructions than CISC processors. This is not reflected in the benchmarks because they mainly measure the performance of the floating point co-processor.

For the evaluation of the total performance of the systems for interactive image processing the four quantities shown in Table 2 were used. The normalized performance for each test was defined as the median divided by the elapsed time given. The final rating was based on the mean of the normalized performances. This added more weight to the I/O performance than to CPU speed which is reasonable for interactive systems.

# MIDAS Models Interstellar/Intergalactic Absorption Lines

*M. PIERRE, D. PONZ, ESO*

## 1. Introduction

Most of the current tools available in MIDAS, as well as in other image processing systems for Astronomy, are dedicated to the first step of data reduction which is to eliminate the instrumental signatures from the observations. This is clearly the main priority for such a system and continuous development is going on to support all the instruments available at La Silla. Very little effort has been dedicated to the complementary problem, the development of analysis tools to bring physical interpretation closer to the observed data. This article describes a new MIDAS context – CLOUD – that allows such an analysis, namely, to model the absorption of interstellar or intergalactic clouds as observed in spectroscopic data.

The programme models absorption features superimposed on a continuum which may also contain emission lines. The resulting output spectrum is computed at a given instrumental resolution and can therefore be used for a direct comparison with observations (provided the lines are resolved). This is particulary suitable for high resolution spectra, as observed by ESO instruments such as Caspec.

The main characteristic of the package is that, on the basis of astrophysical judgement and interpretation of results, the user can interactively determine the model parameters: the user elaborates on the model that will then be compared to the observations. No chi-square evaluation is performed by the programme which is then not to be considered as an extension of the fitting package.

The software will be available on an experimental basis in the next release of MIDAS and is also available in the portable version running under UNIX and VMS.

## 2. Description of the Method

The processes of formation of interstellar or intergalactic absorption lines can be simply described by atoms aggregated in discrete clouds along the line of sight, between the observer and an emitting source.

Each cloud is assumed to produce a single line whose position is determined by the mean velocity of the cloud and whose depth is related to the number of absorbers. Atoms within the same cloud have a certain velocity dispersion and therefore tend to broaden the line profile. In our case, we adopt a Maxwellian velocity distribution, purely thermal, so that $\sigma_v \alpha \sqrt{T}$. Moreover, because of the finite lifetime of the excited state of the corresponding atomic transitions, lines have also a natural intrinsic width. This phenomenon, while negligible with respect to thermal broadening for rather low column densities, tends to dominate when lines become saturated. The resulting absorption profiles are the so-called "Voigt profiles" and are those derived by the programme.

In addition to the commands which perform the calculations, the package contains:

- A catalogue of atomic constants, stored in a table which can be updated by the user.
- A table containing the user's guess for the cloud model; i.e., for each absorbing cloud: wavelength, column density, thermal width, atomic transition.
- A table containing parameters for possible gaussian emission lines to be added to the continuum.
- Coefficients for the continuum, assumed to be polynomial, and the definition of the sampling domain of the resulting images.

The modelling proceeds as follows:
1. Creation of the instrumental response (PSF), as a gaussian of given FWHM. It may be also any other experimental function supplied by the user.
2. Creation of a 1D image containing the continuum and possible emission lines.
3. Creation of absorption features on this image according to the cloud model table and convolution of this spectrum with the PSF.
4. Comparison of the resulting spectrum with observations. The user can then modify some of the input parameters and repeat the operations until the agreement is found to be satisfactory.

A complete description of the package is given in the forthcoming version of the MIDAS Users' Guide. An on-line tutorial, based on high resolution data, is also available.

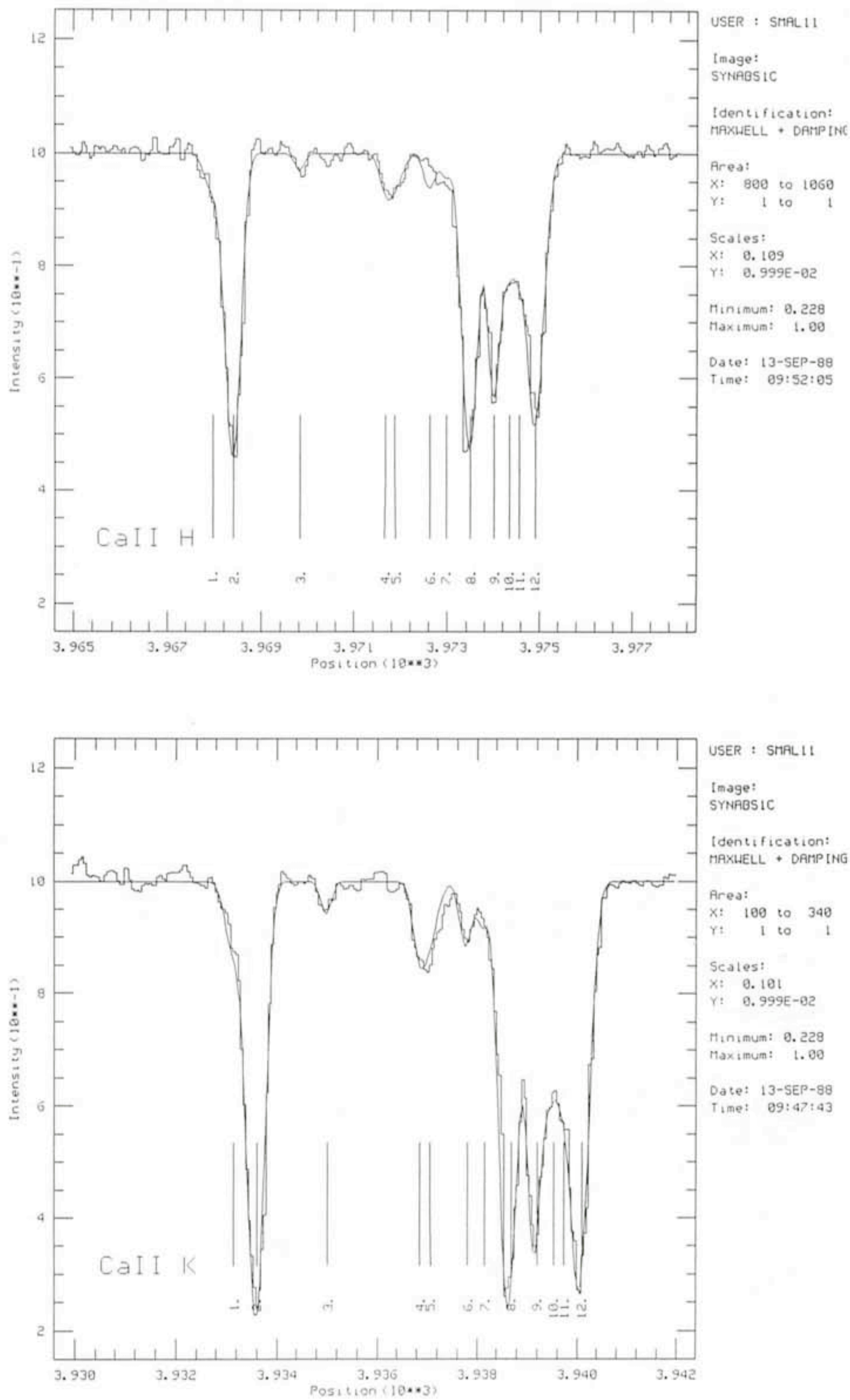



Figure 1 a, b: *Model (smooth line) for the H and K components compared with the observations (step function). The two components have been modelled simultaneously and corresponding line identifications are given in Tabel 1.*

## 3. An Example

As an example, we present here the modelling of the series of CaII absorption doublets in the spectrum of SN

1986 G in NGC 5128 observed with Caspec (D'Odorico et al. 1988).

The two images (components K and H of the doublet) have been pre-reduced so that the continuum is normalized to 1. Sampling is 0.05 Å per pixel and the instrumental resolution, 0.22 Å.

The final model consists of 12 absorption clouds (Table 1).

Figure 1 shows the resulting image convolved with a gaussian PSF of 0.22 Å FWHM, compared with the observations.

Comparison of these results with those derived by a similar package (STAR-LINK) shows complete agreement.

The example discussed here is also demonstrated in the MIDAS on-line tutorial.

TABLE 1. *Cloud model table.*

| Seq. no. | VELOCITY | BVAL | N |
|---|---|---|---|
| 1 | −38.37775 | 13.00 | 0.5400 E+12 |
| 2 | −4.395716 | 13.00 | 0.6600 E+13 |
| 3 | +102.8715 | 5.000 | 0.1700 E+12 |
| 4 | +241.7751 | 8.000 | 0.3000 E+12 |
| 5 | +256.8906 | 15.00 | 0.5500 E+12 |
| 6 | +313.5179 | 8.000 | 0.4000 E+12 |
| 7 | +339.8785 | 7.000 | 0.2500 E+12 |
| 8 | +379.1504 | 13.00 | 0.6300 E+13 |
| 9 | +418.3698 | 11.00 | 0.4300 E+13 |
| 10 | +443.2433 | 8.000 | 0.1300 E+13 |
| 11 | +459.1050 | 4.500 | 0.8000 E+12 |
| 12 | +486.2531 | 16.00 | 0.6300 E+13 |

Column 1: velocity of the clouds in km/s.
Column 2: broadening parameter ($\sqrt{2kT/m}$) in km/s.
Column 3: column density in number of atoms/cm$^2$.


## Acknowledgements

The programme ALAS developed by M. Pettini was a source of inspiration during the design of our package.

We are indebted to S. D'Odorico for providing the data used in our example, and thank D. Baade for useful suggestions.



*References*

D'Odorico, S., di Serego Alighieri, S., Pettini, M., Magain, P., Nissen, P.E., Panagia, N.: 1988, submitted to *Astronomy and Astrophysics*. "A study of the interstellar medium in line to NGC 5128 from high resolution observations of the supernova 1986 G."

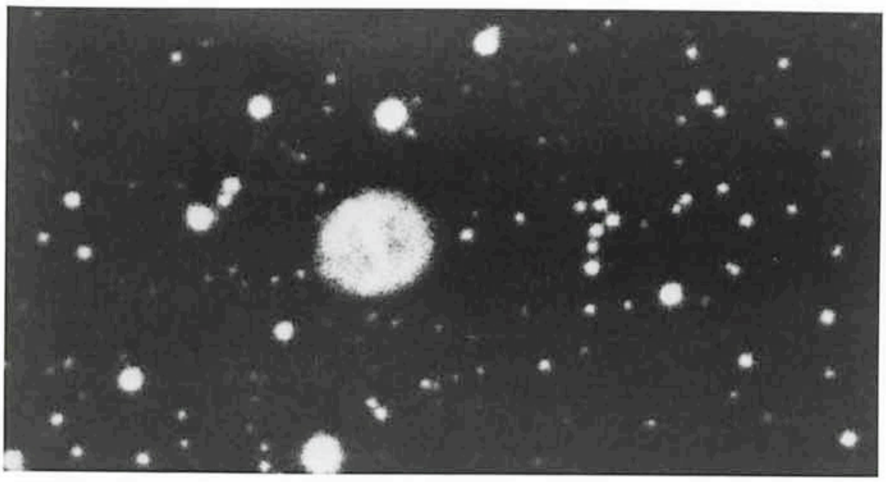

## ESO Book Now Available in Five Languages

With the publication of French and Spanish versions now planned before the end of the current year, and a second edition in Danish – the first one was sold out in less than two months last year –, the ESO Book "Exploring the Southern Sky" will soon become available in five languages.

The publishers are: Danish (Rhodos; Copenhagen), English (Springer Verlag; Berlin, Heidelberg, New York), French (Les Editions de Physique; Paris), German (Birkhäuser Verlag; Basel, Boston), and Spanish (Equipo Sirius; Madrid).

## TO ALL READERS

Please make sure that the card which accompanies this issue of the *Messenger* is returned, if you want to continue to receive the journal. *The editors*



## A Celestial Riddle . . .?

Look at this picture, reproduced from one the ESO Schmidt plates obtained for the red half of the joint ESO/SERC Atlas of the Southern Sky. The bright, round object is the planetary nebula PK 274 +3°.1. The object to the right of it is . . . just some galactic stars.

Is somebody trying to tell us something?

## STAFF MOVEMENTS

### Arrivals

**Europe:**

PÉRON, Michèle (F), Astronomical Applications Programmer

SCHNEIDER, Karin (D), Secretary

SLATER, Roswitha (D), Accounts Clerk

VAN DE SPRENG, Jacob (NL), Project Control Officer

**Chile:**

GEMPERLEIN, Hans (D), Infrared Instrumentation Engineer

GUNNARSSON, Lars (S), Associate (Microwave Engineer SEST)

NYMAN, Lars (S), Associate (Telescope Scientist SEST)

### Departures

**Europe:**

ARSENAULT, Robin (Canadian), Associate

IOVINO, Angela (I), Fellow

BUONANNO, Roberto (I), Associate

**Chile:**

MAUGIS, Michel (F), Electronics Technician

## Christian Perrier Receives Award

On October 19, 1988 Christian Perrier received the "Prix DIGITAL – Societé Française des Spécialistes d'Astronomie" for his outstanding research in infrared interferometric imaging. The price is awarded to young scientists, less than 37 years of age, who have a record of scientific research of high quality and of international stature. Much of Perrier's work has been done with-in ESO. He spent three years at La Silla as a French Coopérant and ESO Fellow and one year thereafter at Garching putting into operation the ESO Infrared Specklegraph and its data reduction software. Several ESO *Messenger* articles have reported on his work. ESO is proud of Christian Perrier's success and congratulates him on this well deserved award. *J. BECKERS*