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http://isowww.estec.esa.nl/isoinfo/isoinfo-12/

Newsletter on the Infrared Space Observatory

Introduction

K. Leech

Welcome to the twelfth issue of *ISO* INFO, the newsletter published at irregular intervals to keep the astronomical community informed of the progress of the European Space Agency's (ESA) Infrared Space Observatory (*ISO*).

This issue is being printed relatively soon after *ISO* executed a station keeping manoeuvre and its third Direct Liquid Content Measurement (DLCM), which gave a refined lifetime estimate – see the 'Project Status' section of this newsletter.

This newsletter includes three reports of science done with *ISO* data and a review of *ISO*'s first workshop on analytical spectroscopy with SWS, LWS, PHOT-S, and CAM-CVF, held in October 1997 at *ISO*'s Villafranca control centre. These articles give a flavour of the impact *ISO* is having on astronomy.

Project Status

M. Kessler

Operations of *ISO* continue to go very smoothly, with all satellite and ground segment systems continuing to perform excellently. Operational highlights of the past 6 months include: the third (and expected to be last) station keeping manoeuvre and liquid helium measurement on 11 December; and the successful survival of the extended eclipses.

For the third station-keeping manoeuvre, the hydrazine thrusters were used for 4 mins 17.5 secs to raise the semi-major axis of the orbit by about 26 km. This delta-v (of about 1 m/s) stops the eastward drift and induces a slow westwards drift in ISO's orbit. The performance of the manoeuvre matched plans to within 0.27%! Also on 11 December, the third direct measurement of the amount of liquid helium remaining on-board was made by activating the two heaters for a period of 24.2 secs. The results were consistent with the earlier measurements, with indications that the lifetime will be at the upper end of the predicted range of 10 April ± 2.5 weeks.

During much of September and early October, *ISO*'s orbital geometry in the extended mission was such that it underwent eclipses with durations up to 166.5 minutes as compared to the design value of some 80 mins. Additionally, during early September, marginal violations of the earth constraint on the pointing direction could not be avoided for some minutes each day as *ISO* went through perigee. Special operational measures were put into place for this period, including restrictions on pointing directions and on the number of instruments that could be used. *ISO* successfully came through this difficult period with better-than-expected battery and pointing performance and less-than-expected impacts from the unavoidable violation of the pointing constraints.

The first chance for *ISO* to look at the Orion and Taurus areas came in August-September and, despite the necessary operational restrictions as described above, many observations were performed. Given the current estimates of the lifetime, a second visit – in parallel with observations of the Galactic Centre– will be possible in the Spring.

Since the last newsletter, the ISOPHOT polarisation modes (PHT50/51) have been released for use with a limited selection of filters and apertures.

The Observing Time Allocation Committee Panel Chairs met on 16 September to consider the overall status of the programme and to make recommendations concerning use of time originating from the expected longer lifetime of *ISO*. The principal conclusions were: that the amount of discretionary time should be significantly increased for the rest of the mission; that an additional ≈200 hours should be made available to the previously-approved large surveys; and that some 300 hours should be devoted to observations of general interest which should be placed in the public domain without the usual 12 months proprietary period.

Further information on *ISO*'s status may be obtained from the WWW, starting from URL: http://isowww.estec.esa.nl/

ISO to the Peaks

M. Harwit

Between the 6th and 8th of October *ISO*'s first workshop on analytical spectroscopy with SWS, LWS, PHOT-S, and CAM-CVF (popularly known as "ISO To The Peaks") was held at *ISO*'s Villafranca control centre. The workshop brought together about one hundred observers and theorists and highlighted the importance of an interplay between observations, laboratory simulations, theoretical modeling, and instrument characterization.

The proceedings of the workshop will be published as ESA SP-419 in early-January, and selected talks (mainly instrumental) are available on the ISOWeb from the publications section of http://isowww.estec.esa.nl/science/. This article is an abridged version of the conference summary talk.

For the past several decades, laboratory astrophysicists, notably Mayo Greenberg in Leiden, were conducting experiments to obtain infrared spectra of interstellar constituents at low temperatures. We noted their work but lacked the ability to obtain the necessary spectra that could have been matched to laboratory data. With *ISO*, all this has changed. At the *ISO* Peaks meeting we saw beautifully clear spectra of interstellar ices of water vapor H_2O, methane CH_4, formaldehyde H_2CO, carbon monoxide CO, and carbon dioxide CO_2. Spectral shapes showed mixtures of these species in both polar and apolar ices – signifying an embedding in a matrix rich, respectively, in H_2O or CO_2. Pascale Ehrenfreund pointed out an important missing ingredient: we have not observed significant levels of admixed solid O_2 in these ices.

Ices are useful indicators of the temperatures of the star-forming regions in which they are observed. CO and O_2 ices sublime at an astrophysically significant rate at roughly 20 – 25K. This is appreciably lower than the sublimation temperatures of CO_2 or H_2O,that lie, respectively, in the range of 55 – 80K and 100 – 150K. Chris Wright showed us spectra of several regions containing young stellar objects. In some, CO appeared fully frozen; in others partially frozen with some addition of gas; and finally, in still others, in fully gaseous form.

To date, laboratory astrophysicists have largely worked with materials more or less deposited in bulk on cryogenically cooled surfaces. Yet, we know that the diffuse interstellar features originate in grains that might be aggregates of no more than ~ 100 atoms. In recent years, however, studies of the properties of atoms such as sodium in clusters numbering about a hundred atoms, have revealed new physical characteristics that differ from bulk properties of the same atoms – e.g. surface effects become important and bond angles change. We may, therefore, expect that the spectra of small aggregates of interstellar atoms and molecules might substantially differ from bulk spectra obtained in the laboratory. Though technically difficult, it should be fruitful to investigate laboratory spectra of small aggregates of atoms, molecules, and perhaps admixtures of ions, that are likely to be important interstellar constituents.

While such considerations are important, there is no doubt that even the bulk properties of different minerals catalogued to date already yield striking results. Louis d'Hendecourt showed us a laboratory spectrum of the magnesium rich olivine mineral forsterite from 10 to 40 μm and its excellent fit to the dust spectrum of comet Hale-Bopp, again illustrating the usefulness of a broad compendium of spectra of widely differing molecular and mineral species. As Jacques Crovisier then added, the superposed 2.7μm H_2O water vapor ν_3 bands yield an ortho-para ratio of ~ 2.45 for this comet, suggesting equilibration at a temperature of 25K, corresponding to a distance of order 100 AU from the sun.

This brings up a second point that clearly emerged at this meeting. Theorists, who for decades have been predicting the shapes of infrared spectra expected from a variety of astronomical sources, now are able to verify the great power of their techniques. Therèse Encrenaz showed us a model spectrum of Saturn that included phosphene PH_3, arsene AsH_3, ammonia NH_3, deuterated methane CH_3D, and a slight trace of water vapor H_2O. Were it not for the spectacularly good fit that all the other constituents provide to the spectrum of Saturn observed with *ISO*, the small differences made by the traces of water vapor would never have been noticed. Thanks to the theoretical fits, however, H_2O is clearly detected. We are now asking whether it originates in infall of material from the Saturnian rings or possibly signifies other sources.

Just as comprehensive stellar models are essential for calibrating the *ISO* instruments, so are reliable calibrations essential for understanding the spectra of stars with dynamic atmospheres. Josef Hron and Bernhard Aringer showed us how difficult it is to account for the atmospheres of Asymptotic Giant Branch stars, where theoretical models would require a detailed understanding of the properties of dust, stellar pulsations, winds, mass loss & shocks. Here, well-calibrated spectra from *ISO* are in strong demand for more sophisticated atmospheric modeling.

While modeling of stellar atmospheres is important, we are also pursuing models of interstellar clouds. We need to gain a better understanding of chemical processes and the spectra that would identify them as interstellar clouds collapse, are shocked, form new molecular species, or are lit up by the formation of a new star. We can test such models of chemical networks against *ISO* spectra.

A most useful tool for studying a variety of gaseous domains is the CLOUDY program of Gary Ferland. His collaborator, Peter van Hoof, displayed how this program facilitates the study of photodissociation regions (PDRs) and starburst galaxies. Both Frank Bertoldi and Pierre Cox showed us the information that now can be derived for PDRs. In particular, a large number of rovibrational emission lines of H_2 are clearly discerned. If we select only the rotational transitions of the ground vibrational state, we can plot the excitation energy of a given rotational state J against observed column densities $N(J)$ divided by statistical weight $g(J) = n(2J+1)$. Here $n = 3$ for ortho and 1 for para states, respectively the odd and even angular momentum states including $J = 0$. The slopes of these plots for the PDRs in S140 and NGC 7023 reveal surprisingly high temperatures, respectively, 500 and 580K.

In the planetary nebula NGC 7027 Xiaowei Liu showed us spectral features of CH^+ that he, José Cernicharo and coworkers had identified. Once again, long-available laboratory spectra permitted this identification. Unidentified lines in this and other planetary nebulae, however, persist and may arise from unknown molecular species.

The ratio of interstellar N^{++}/O^{++} as a function of distance from the Galaxy's center was originally studied from the KAO. By extending such studies across the Galaxy and looking at both the Large and Small Magellanic Clouds, Jean-Paul Baluteau found a decreasing nitrogen-to-oxygen ratio at increasing distances from the Galactic Center. This decline continues as we go to the LMC and SMC. Studies of this kind should permit us to obtain greater insight on the chemical evolution of galaxies on time scales of billions of years.

A considerable body of work on active galactic nuclei (AGNs) and starburst galaxies has been carried out. Dieter Lutz showed us that the archetypical ultraluminous galaxy Arp 220 has a [NeII]/[OIV] ratio more similar to starbursts than to AGNs. In contrast to these two near infrared lines seen in emission, Jacqueline Fischer showed us a long wavelength spectrum of molecular lines all of which are seen in absorption. The sole emission line in the far infrared appeared to be [CII] at 158 μm. Her spectra would lead one to conclude that enormous opacities exist surrounding the sources of heating and a mid-infrared optical depth of order 20 at the wavelengths of [NeII] and [OIV]. It is difficult to explain how these lines can be seen strongly in emission while the [CII] line, which lies at much longer wavelengths where opacities are low, is so weak.

An equally difficult question to answer is why ultraluminous galaxies should in the first place contain so much dust when they appear to be merely two ordinary colliding galaxies? Where does all the dust come from? How is it distributed around the star forming regions? Where does it lie in relation to the molecular constituents?

ISO is an observatory. The workshop showed the power of a single instrument, intensely studied to properly characterize all its features, and used by a large number of observers all sharing information to perfect the characterization. It showed the importance of the stability of conditions in space, and of systematic, periodic updates of calibrations and the tracking of slowly varying instrumental characteristics. The process is not yet complete. A great deal of additional information about the detectors, telescope and their properties remains to be extracted. But the possibility of learning from each other as we begin to better understand our data and the instruments that obtained them, will yield a far richer lode of interpretable observations than if we were individually trying to use some arbitrary telescope.

This cooperative attitude is responsible for much of the observatory's success. We owe the Instrument Teams, the Instrument Data teams, and the operations specialists a great debt of thanks for their hard work on the community's behalf.

Discretionary Time Proposals

M. Kessler

A small pool of ISO observing time, called "Discretionary Time", is being kept available for observations which could not have been foreseen at the time of the proposal process. Details on applying for discretionary time may be found on the *ISO* WWW server at ESTEC either by following the links from *Proposals*—/ on the home page or directly at http://isowww.estec.esa.nl/discrete/disc_time.html

A list of successful discretionary time proposals since the last newsletter follows.

PI	Institute	Proposal
Abraham, P.	MPI für Astr., Heidelberg, D	Very Cold Dust Around Herbig Ae/Be Stars
Barr, P.	SA, ESTEC, NL	ToO of the optical flaring Quasar BL Lac
Baudry, A.	Obs. de Bordeaux, F.	Detection of OD in Orion A: OD in Hot Molecular Cores
Baudry, A.	Obs. de Bordeaux, F	Detection of OD in Orion-KL
Blommaert, J.	ISO SOC, VILSPA, E	Evolution and Mass Loss of AGB Stars in the Small Magellanic Cloud
Castro-Tirado, A.	LAEFF-INTA, Madrid, E	The nature of the superluminal galactic source GRS 1915+105: ISO observations during the Oct 1997 X-ray and radio-outburst
Castro-Tirado, A.	LAEFF-INTA, Madrid, E	ToO: New soft gamma-ray repeater (SGR 1814-1340)
Cernicharo, J.	CSIC, Madrid, E.	A Study of Water Emission in Orion
Crovisier, J.	Obs. de Paris, Meudon, F.	Spectroscopic observations of comet Hale-Bopp
Deharveng, L.	Obs. de Marseille, F.	Imaging of massive star forming region: Study of Sh 88B
Forveille, T.	Obs. de Grenoble, F	ISOCAM CVF spectrum of the newly discovered nearby Brown Dwarf DENIS-P J0205-1159
Haas, M.	MPI für Astr., Heidelberg, D	Very cold dust in the dwarf elliptical galaxy N205
Hanlon, L.	University College, Dublin, IRL	ToO: Search for IR counterparts to Gamma ray Bursts
Hurley, K.	University of California, USA	Spectroscopy of IRAS 18119-1342, the possible counterpart to the new Soft Gamma-Ray Repeater
Ivison, R.	ROE, Edinburgh, UK	A New Window on Galaxy Formation and Evolution
Jordain de Muizon, M.	LAEFF-INTA, Madrid, E	Tentative Detection of Solid O_2 in Interstellar Grain Mantles
Kegel, W.	Universitaet Frankfurt/Main, D	OH-megamasers: Pump mechanism, possible iraser-line
Kidger, M.	IAC, Tenerife, E	160 μm Polarisation Observation of BL Lac in Outburst
Klaas, U.	ISO SOC, VILSPA, E	The IR Spectral Energy Distribution of the Circinus Galaxy
Koornneef, J.	Kapteyn Institute, NL	A Unique B[e] Star: ISO discovers high excitation gas
Krishna, G.	Tata Institute, India	Gaseous Superdisks in powerful radio galaxies
Krishna, G.	Tata Institute, India	Mid- and Far-IR properties of Nearby Radio-Loud Ellipticals.
Kunth, D.	IAP, Paris, F	PAH molecules in Star-forming galaxies: Influence of metallicity and UV radiation field.
Lellouch, E.	Obs de Paris, Meudon, F.	The surface temperature of Pluto
Luhman, M.	NRL, Washington, USA	[CII] In Nearby ULIGs: Probing the Starburst Age and the Luminosity Source
Mezger. P.G.	MPI für Radioastr., Bonn, D.	Imaging and Spectroscopy of the Unusual IR Source 1742-3005
Moneti, A.	ISO SOC, VILSPA, E	The Nature of the Pistol, its Star and the Quintuplet
Morris, P.	ISO SOC, VILSPA, E	Ices towards the Candidate LBV G79.29+0.46
Neufeld, D.	Johns Hopkins University, USA	Search for Hydrogen Fluoride in OMC-1 and W51
Pilbratt, G.	SA, ESTEC, NL	ISOCAM M16 imaging follow-up: CVF spectro-imaging
Prusti, T.	ISO SOC, VILSPA, E	Distance to a Cepheid
Saraceno, P.	CNR-IFSI, Frascati, I	W28 A2 Revisited
Sellgren, K.	Ohio State University, USA	Imaging of Infrared Emission Features in Reflection Nebulae
Siebenmorgen, R.	ISO SOC, VILSPA, E	Coronographic Photometry and Polarimetry of Proto-Planetary Disks
Stapelfeldt, K.	JPL, Pasadena, USA	The Spectral Energy Distribution of HH30
Stark, R.	MPI für Radioastr., Bonn, D	A protostar in the southern ammonia core of L183?
Stickel, M	MPI für Astr., Heidelberg, D	Cold Dust in the Intracluster Medium of Galaxy Clusters
Van Dishoeck, E.	Leiden Observatory, NL	SWS FP Observations of Highly-excited H_2O Absorption towards Orion IRc2
Van Winckel, H.	Instituut voor Sterrenkunde, Leuven, B	Circumstellar Chemistry and Physics of Post AGB Star HD213985
Walker, H.	Rutherford Appleton Lab., UK	Spectra of RCrB Dust Shells
Walker, H.	Rutherford Appleton Lab., UK	High resolution scans across Vega-like disks
Walmsley, M.	Osservatorio Astrofisico Arcetri, I	Atomic Silicon in Orion
Wright, C.	Sterrenwacht Leiden, NL	SWS spectrum of the Orion shock Peak 2
Wright, C.	Sterrenwacht Leiden, NL	LWS observations of HD toward the Orion Bar
Zavagno, A.	Obs. Marseille, F.	Observation of AFGL 4029

LWS studies of Virgo galaxies

K. Leech
for the Virgo consortium

The ISO Guaranteed Time program VIRGO is an ISOPHOT 40 – 220 μm study of a complete volume-limited, unbiased sample of spiral, irregular and BCD galaxies from the VIRGO cluster, selected from the Virgo Cluster Catalogue (VCC) of Binggeli *et. al.* 1985, AJ 90, 1681, as described in Boselli *et. al.* 1997, AA Supp 121, 507. From these galaxies a sample of 19 cluster spiral galaxies was selected for study with LWS around the [CII] 157.68 μm fine structure line. This line probes not only photodissociation regions (e.g. Stacey *et. al.* 1991, ApJ 373, 423) associated with massive star formation, but also, potentially, the quiescent diffuse HI component of the interstellar medium. The subsample of 19 galaxies comes from the cluster core (within 2 degrees of M87) and periphery (more than 4 degrees from the position of maximum galaxy surface density), enabling us to probe any difference between the conditions in the core and periphery. Here we present a preliminary reduction and analysis of the LWS spectra.

VCC Galaxies observed by LWS, together with background reference positions to check for foreground [CII] emission from the Milky Way, were observed between 30th June and 15th July 1996. No problems were reported with any observation. The Auto Analysis Results from OLP versions 5 and 6 were processed using the ISO Spectral Analysis Package (ISAP) by: reading data in; discarding bad LWS data points; averaging scans for detector 8 (the one that covers the 158 μm region); rebinning; and finally fitting gaussians to any lines seen in the data to obtain flux and central wavelength.

Of the 19 galaxies in the sample, 15 were detected. An example galaxy, VCC 66, is shown in figure 1, Of the six background positions used, five had no detectable emission and one was mistakenly pointed at one of the galaxies in the sample (confirming the line flux and wavelength for that galaxy). We therefore conclude that the instrumental setup used was insufficient to detect any foreground [CII] emission from our own galaxy and therefore none of the galaxy detections are contaminated by galactic [CII].

Figure 2 shows the relation between dust continuum and [CII] emission for 13 galaxies also observed in the broad band C160 filter (centered at 175 μm) by Völk et al. (in preparation). As the pixel areas are similar (90" circular for LWS, 89 $\times$ 89" for ISOPHOT-C200), the plot denotes the relation between the [CII] and dust emission from the projected inner 7 kpc of

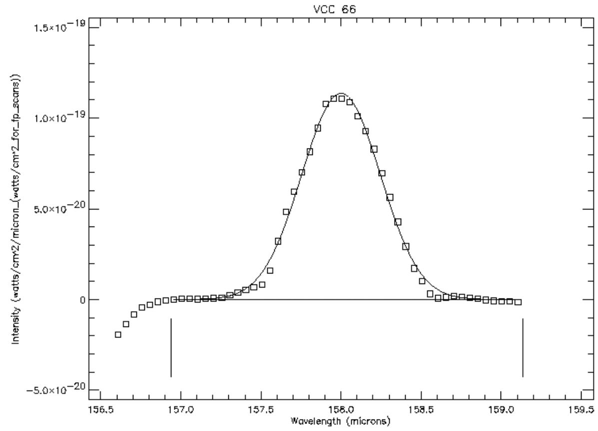

Figure 1: *LWS spectrum of VCC 66 around [CII]. The vertical lines are limits used by the line fitting program, and the negative flux values below 157 μm are a processing artefact.*

each galaxy (for a 15Mpc cluster distance). Upper limits are 3 sigma. As the FIR continuum brightness from dust typically has a pronounced spectral maximum in the C160 filter range, the plot can be interpreted in terms of ratios between line and dust continuum luminosity. The dotted line in fig. 2 is not a fit but denotes a linear relation between FIR brightness and [CII] brightness such that the ratio of line to continuum luminosity integrated over the C160 filter, after correcting for the different aperture sizes, is 0.5 percent. The one galaxy not detected by either LWS or ISOPHOT is VCC 1158, a B_T 12.1 magnitude Sa from the cluster core region.

Although statistics are poor and there are large intrinsic line/continuum ratio variations between galaxies, the data show an overall linear correlation between [CII] and dust continuum luminosity, broadly consistent with the LWS [CII] measurements in 5 Sc or later Virgo spirals by Smith *et. al.* AJ 1997 114, 138. Galaxies which have higher continuum and line brightnesses tend to have later Hubble types, qualitatively consistent with an interpretation in which the [CII] emission from the central regions is proportional to the surface density of photodissociation regions, and the dust is substantially heated by the non-ionising UV radiation field. The tendency for the correlation to flatten off with increasing brightness, as observed by Stacey *et. al.* for a sample embracing starburst and ultraluminous galaxies, is not apparent for the relatively quiescent Virgo sample. There is no apparent relation between the [CII] line/dust continuum ratio and position in the cluster or HI mass surface density in the galaxian disks. Any relation of the [CII] emission to the diffuse HI component of the ISM is not obvious, at least for the central regions of the disks observed.

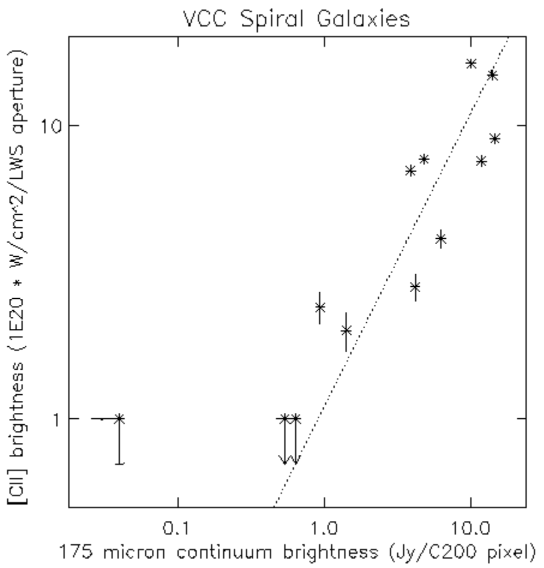

Figure 2: *Correlation between [CII] brightness observed towards the nucleus of 13 galaxies also observed through the ISOPHOT-C C160 filter. The ISOPHOT error bars are smaller than the symbol size, represent random uncertainties only and do not contain the systematic uncertainty in the calibration.*

A model for the ring galaxy VV330

C. Bonoli, P. Mazzei & A. Curir

Ring galaxies are the sites of vigorous non nuclear star formation. They generally have high far-IR luminosities and large far-IR color temperatures compared with "normal" galaxies. Because of its geometrical simplicity, the collisional ring galaxy can be used to explore differences between the behaviour of gas and stars in collisions. New long wavelength ISOPHOT data for VV330, a ring galaxy previously observed by one of us (C.B.) in BVRI and detected by IRAS at 60 and 100 μm, allow us to analyse the shape of its overall SED from B to 200 μm. BVRI CCD observations have been performed and reduced as described in Mazzei, Curir and Bonoli (AJ, 110, p.559, 1995). IR observations were carried out on the ISO's 288'th revolution with the ISOPHOT camera using the C200 array at 120, 160 and 200 μm (PHT22). Data have been reduced using the Phot Interactive Analysis (PIA), Version 6.4. Starting from Edited Raw Data (ERD) level we corrected data for non–linearity of integration ramps and glitch events; drift stability analysis, dark current, background subtraction and flux calibration have been also performed.

We analysed the morphological and photometric properties of the galaxy VV330 providing a suitable dynamical model through Smooth Particle Hydrodynamical (SPH) simulations and Evolutionary Population Synthesis (EPS) models to account for the photometrical behaviour from UV to far-IR.

We performed SPH simulations of central collisions between a disk system with an intruder, using the code described in Curir and Mazzei (MNRAS, submitted, 1997). The disk encloses stellar and gaseous components with a relative mass ratio of 0.1. The intruder is a King sphere of different radius but the same mass as the target disk. A series of collisions varying the velocity of the companion have been performed. The dynamical properties of these interactions and the role played by the dynamical friction have been widely investigated in Mazzei, Curir and Bonoli (AJ 110,p. 559, 1995) and in Curir and Filippi (A&A 305,p. 740 1996). The presence of the halo allows the gas to stabilize quickly (see Fig. 1).

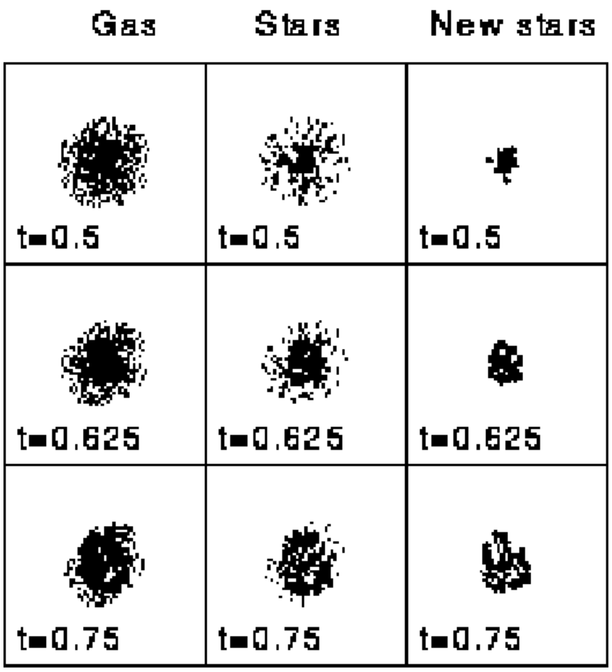

Figure 1.

Our chemo–photometric EPS model is the first one accounting for, in a self–consistent way, chemical evolution, stellar emission and internal absorption and re-emission by dust (Mazzei, P. *et. al.* ApJ, 422, 81, 1994). Dust includes a diffuse component, heated by the general radiation field, and a warm component associated with HII regions. Emission from PAH molecules and from circumstellar dust shells are also taken into account. We match the overall SED of VV330 with a burst lasting 0.15 Gyr with an intensity (i.e. the ratio between the star formation rate before and that at the onset of the burst) equal to 60 using a Salpeter's IMF with lower mass limit of

$0.05\,m_\odot$ and an upper one of $100\,m_\odot$ (Fig. 2).

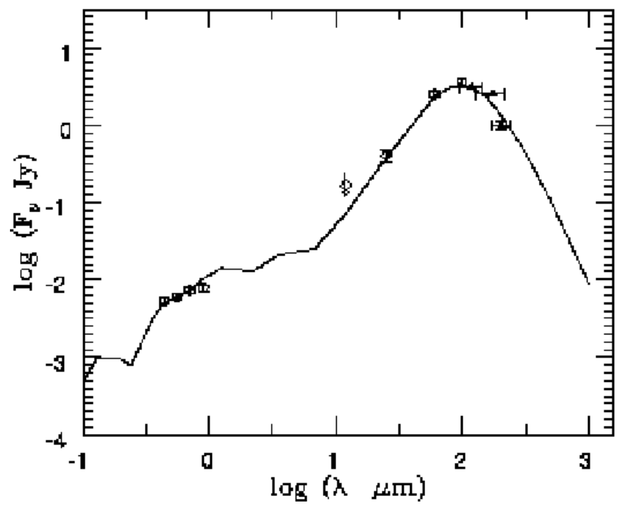

Figure 2.

ISO data suggest a warm/cold dust luminosity ratio of 1.1 instead of 0.43 as in our own galaxy (Mazzei, P. *et. al.* A&A, 256, 45, 1992), an intensity of the diffuse radiation field 4-5 times higher than that in the Galaxy and L_{FIR}/L_{bol} ratio which exceeds those of normal disk systems at least by a factor 2.

Evidence for Remnant Circumstellar Disks Around Post T Tauri Stars

A. Moneti

In order to determine determine the timescale for the dissipation of disks around pre-main sequence (PMS) stars, we have obtained LW2 ($\sim 6.5\,\mu$m) and LW3 ($\sim 15\,\mu$m) ISOCAM imaging photometry of six Lindroos (Lindroos, K.P. 1986, A&A 156, 223) binary systems in order to determine whether they have detectable infrared excesses that could be ascribed to dust in circumstellar disks. These binary systems are composed of an early-type MS primary and a late-type companion. Given the youth of the system, determined from the age of the primary (typically > 10 Myr), the secondary would still be contracting towards the Main Sequence. These companions would classify as true post T Tauri (PTT) stars as originally defined by Herbig (Herbig, G.H. 1978, In Mirzoyan, L.V. (ed.), Problems of Physics and Evolution of the Universe, Armenian Acad. Sci., Yerevan, p. 171), i.e. low-mass PMS stars that are older than the classical T Tauri stars (TTS) but that have not yet settled on the main sequence. These stars would be located on the radiative part of the pre-Main Sequence evolutionary tracks. Note that whereas the "weak" TTSs were at first thought to be PTT stars, further studies have shown that they are roughly coeval with the classical TTSs.

We observed seven Lindroos binaries found by Pallavicini et al. (A&A 261, 245 1992) to show clear evidence of youth. Each observation consisted of a 3×3 raster with an integration time of ~ 20 sec per position (depending on the number of valid readouts, which varied between 8 and 10), preceded by stabilization frames which, in most cases, could partly be used in the reduction. The observations were performed through the $3''$/pix Field-of-View (FOV) and using steps of a single pixel. Such small step size was chosen to ensure that the companions would not fall out of the FOV, though at the price of not being able to use the observations for preparing a flatfield.

During the observations, one source (HD108767) caused heavy saturation and two other sources (HD113703 and HD143939) showed saturation on single readouts. These saturations were due to the bright primaries and do not have a significant effect on the companion photometry.

Data reduction was performed with the CAM IA package following the standard steps up to the production of calibrated mosaics. While the overall absolute uncertainty are of order $\pm 20\%$, most of the error is expected to be systematic, and relative uncertainties could be as low as $\pm 5\%$. Photometry was then extracted using the IRAF/DAOPHOT and using library PSFs for fitting. While the library PSFs probably do not provide the best PSF for each frame, they do provide a certain degree of uniformity in the measurements. In two instances the companion is too close to the primary and/or too faint relative to it for measurement, and in the cases of the heavily saturated primary the fit was performed using the wings of the profile only, though the results are not considered reliable. In the end we have reliable fluxes for three primaries and five secondaries. For the preliminary analysis of the results, we consider the ratio $R = F_{6.5}/F_{15}$. The results of the photometric measurements are summarised in Table 1.

From Table 1 we find that $\langle R \rangle = 5.7$ for the three well measured primaries and 3.4 for the five well measured companions; this difference we consider significant. For comparison $R \approx 5.0$ for a hot (10,000 K) star and $R \approx 4.5$ for a cool (4,000 K) star (where actually these ratios have been computed from blackbodies at the stated temperatures), indicating that the different spectral energy distribution of the photospheres is not sufficient to account for the observed differences (a blackbody at 1600 K would give $R = 3.4$). We thus conclude that most of the difference is due to an excess of emission at $15\,\mu$m, and we interpret this as clear evidence for remnant cool circumstellar disks around these *adolescent* stars.

We do not believe that we can go much beyond this conclusions at present, though some improvement will be possible in the future with improved reduc-

Table 1: Photometric Results

HD number	age[a] [Myr]	dist.[b] [pc]	$F_{6.5}$ [Jy]	F_{15} [Jy]	R	sep.[c] [″]
560	< 50	100 ± 8	too close		–	–
108767-A	< 110	27 ± 5	†7050	575	†12.2	
-B			300	60	6.0	24.8
113703-A	< 35	127 ± 12	†990	120	†8.1	
-B			42	12	3.5	10.6
113791-A	< 11	126 ± 13	1000	135	7.4	
-B			52	14	3.7	24.9
127304-A	< 79	107 ± 8	290	50	5.7	
-B			18	5	3.6	25.8
129791-A	< 18	130 ± 16	165	40	4.1	
-B			14	5	2.8	35.3
143939-A	< 32	168 ± 27	†133	too	–	
-B			28	close	–	8.9

[a] System ages from Lindroos
[b] Distances from Hipparcos, ESA SP-1200, 1997
[c] Mean of LW2 and LW3 images
† primary is saturated

tion techniques and more accurate calibration. We will then be able to compute simple models in order to place some constraints on the temperature and on the quantity of the circumstellar dust. Given the small observed sample and that the ages are all upper limits, it is impossible at this time to make statements about correlation with age. Observations of another star in our sample, with an age of 100Myr, could have allowed us to make a more definite statement, but it was not observed and will no longer be visible by ISO. For the moment we can only say very tentatively that circumstellar disks appear to have dissipated by an age of 100 Myr.

World Wide Web and Electronic Access

R. Long & J. Matagne

ISOWEB, the *ISO* World Wide Web service at http://isowww.estec.esa.nl/, has continued to expand apace and now contains more than 1500 separate HTML pages and several CGI interfaces (Query Engines) to our on-line data stores. Many of the updates to the server since the last issue of *ISO*Info have concerned the 'ISO/ESA Press Releases' at http://isowww.estec.esa.nl/Press_rel.html and the 'ISO Science Results Gallery' at http://isowww.estec.esa.nl/science/.

To cope with this expansion, a number of measures are in hand to enable users to quickly locate the services they require; an ISOWEB Users' Guide has been written to give newcomers an overview of the ISOWEB and to direct them to heavily used sections of the site (http://isowww.estec.esa.nl/usrguide.html); and the Global Index File for the server (accessed by the Document Search Tool) will be partitioned so that users can perform more focused searches on specific parts of the server (http://isowww.estec.esa.nl/search.html).

In the new year the site will be completely overhauled and restructured to meet the changing needs of its users. One such example is that it is planned to provide an access to the title and the abstract text of each proposal entered in the Mission Data Base. The access will be possible via hyper-link and the "Mission Data Base Snapshot" tool at http://isowww.estec.esa.nl/cgi-bin/obs_pend.inp.

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