THE AGB NEWSLETTER

An electronic publication dedicated to stellar evolution on the asymptotic giant branch and beyond

No. 64 — 01 October 1999

Editors: Thierry Forveille and Claudine Kahane (agbnews@obs.ujf-grenoble.fr)
ISSN 1290-3930

Abstract of recently accepted papers

Velocity Variations of Semiregular Variables in the Infrared

T. Lebzelter[1]

[1] Institut für Astronomie, Türkenschanzstr. 17, A-1180 Wien, Austria

We obtained time series of high resolution spectra around 1.6 μm for 15 short period semiregular variables to study the velocity variations in their atmospheres with the help of second overtone vibration-rotational lines of CO. All objects of our sample clearly show velocity variations of a few km/s. The amplitude of the 'blue' SRVs (according to Kerschbaum & Hron 1992) is on the average a factor of two smaller than that of the 'red' SRVs. Periodicity of the variations differs from star to star. Some SRVs vary with the period listed in the General Catalogue of Variable Stars (GCVS4), others with a considerable longer period. But for all SRVs the measured velocities at 1.6 μm are over a large part of the cycle smaller than the velocities found in the literature. Different explanations of this feature are discussed. We think that the observed difference in mean velocity might be caused by a blueshift due to large convective cells on the stellar surface.

Accepted by Astronomy & Astrophysics

Preprints can be obtained by contacting lebzelter@astro.univie.ac.at

A Search for Technetium in Semiregular Variables

T. Lebzelter[1] *and J. Hron*[1]

[1] Institut für Astronomie, Türkenschanzstr. 17, A–1180 Wien, AUSTRIA

We searched for the lines of Tc in the spectra of Semiregular variables (SRVs) in the wavelength region from 4180 to 4300 Å using high resolution spectroscopy. Tc as an s-process element is produced on the thermally pulsing AGB and is therefore a good indicator for the evolutionary status of Semiregular variables. Combining our results with previous investigations we get a database large enough for a statistical study.

Tc is not found in SRVs with periods below 100 days, spectral types earlier than M5 and photospheric IRAS colours. These objects are 'blue' SRVs in the classification system of Kerschbaum & Hron (1994). Among the 'red' SRVs (periods longer than 100 days) the fraction of stars showing Tc in their spectra is about 15 % with a probably lower fraction among the stars with periods above 150 days. This is significantly lower than for the typical Miras. Taking into account the probable conditions for the occurence of the third dredge-up and the expected behavior of the Tc abundance along an evolutionary track on the AGB, our results support an evolutionary scenario from 'blue' SRVs (early AGB) to 'red' SRVs (early TP-AGB) and on to long period Miras. Only the most massive (masses above $2M_{\odot}$) stars show Tc during the SRV stage. The luminosities of the Tc-rich SRVs and Miras are compatible with theoretical estimates of the minimum core mass required for the third dredge-up.

Accepted by Astronomy & Astrophysics
Preprints can be obtained by contacting lebzelter@astro.univie.ac.at

Period–Luminosity–Colour distribution and classification of Galactic oxygen–rich LPVs
I. Luminosity calibrations

D. Barthès[1]*, X. Luri*[1]*, R. Alvarez*[2] *and M.O. Mennessier*[3]

[1] Departament d'Astronomia i Meteorologia, Universitat de Barcelona, Avda. Diagonal 647, E–08028 Barcelona, Spain
[2] Institut d'Astrophysique, CP 226, Université Libre de Bruxelles, Bld. du Triomphe, B–1050 Bruxelles, Belgium
[3] GRAAL (UPRESA 5024 CNRS), Université Montpellier II, Place E. Bataillon, F-34095 Montpellier Cedex 05, France

The absolute K magnitudes and kinematic parameters of about 350 oxygen–rich Long–Period Variable stars are calibrated, by means of an up–to–date maximum–likelihood method, using Hipparcos parallaxes and proper motions together with radial velocities and, as additional data, periods and $V-K$ colour indices. Four groups, differing by their kinematics and mean magnitudes, are found. For each of them, we also obtain the distributions of magnitude, period and de-reddened colour of the base population, as well as de-biased period–luminosity–colour relations and their two–dimensional projections. The SRa semiregulars do not seem to constitute a separate class of LPVs. The SRb appear to belong to two populations of different ages. In a PL diagram, they constitute two evolutionary sequences towards the Mira stage. The Miras of the disk appear to pulsate on a lower–order mode. The slopes of their de-biased PL and PC relations are found to be very different from the ones of the Oxygen Miras of the LMC. This suggests that a significant number of so–called Miras of the LMC are misclassified. This also suggests that the Miras of the LMC do not constitute a homogeneous group, but include a significant proportion of metal–deficient stars, suggesting a relatively smooth star formation history. As a consequence, one may not trivially transpose the LMC period–luminosity relation from one galaxy to the other.

Accepted by Astronomy and Astrophysics
Preprints can be obtained by contacting barthes@dali.am.ub.es *or via WWW on*
http://xxx.lanl.gov/abs/astro-ph/9909287 (SISSA)

Mass-loss rates and luminosity functions of dust-enshrouded AGB stars and red supergiants in the LMC

Jacco Th. van Loon[1], *M.A.T. Groenewegen*[3], *A. de Koter*[2], *Norman R. Trams*[4], *L.B.F.M. Waters*[2,5], *Albert A. Zijlstra*[6], *Patricia A. Whitelock*[7], *Cecile Loup*[8]

[1] Institute of Astronomy, Madingley Road, Cambridge CB3 0HA, United Kingdom

[2] Astronomical Institute, University of Amsterdam, Kruislaan 403, NL-1098 SJ Amsterdam, The Netherlands

[3] Max-Planck Institut für Astrophysik, Karl-Schwarzschild Straße 1, D-85740 Garching bei München, Germany

[4] Astrophysics Division of ESA, ESTEC, P.O.Box 299, NL-2200 AG Noordwijk, The Netherlands

[5] Space Research Organization Netherlands, Landleven 12, NL-9700 AV Groningen, The Netherlands

[6] University of Manchester Institute of Science and Technology, P.O.Box 88, Manchester M60 1QD, United Kingdom

[7] South African Astronomical Observatory, P.O.Box 9, 7935 Observatory, Republic of South Africa

[8] Institut d'Astrophysique de Paris, 98bis Boulevard Arago, F-75014 Paris, France

A radiative transfer code is used to model the spectral energy distributions of 57 mass-losing Asymptotic Giant Branch (AGB) stars and red supergiants (RSGs) in the Large Magellanic Cloud (LMC) for which ISO spectroscopic and photometric data are available. As a result we derive mass-loss rates and bolometric luminosities.

A gap in the luminosity distribution around $M_{\rm bol} = -7.5$ mag separates AGB stars from RSGs. The luminosity distributions of optically bright carbon stars, dust-enshrouded carbon stars and dust-enshrouded M-type stars have only little overlap, suggesting that the dust-enshrouded AGB stars are at the very tip of the AGB and will not evolve significantly in luminosity before mass loss ends their AGB evolution.

Derived mass-loss rates span a range from $\dot{M} \sim 10^{-7}$ to 10^{-3} $\rm M_\odot$ $\rm yr^{-1}$. More luminous and cooler stars are found to reach higher mass-loss rates. The highest mass-loss rates exceed the classical limit set by the momentum of the stellar radiation field, L/c, by a factor of a few due to multiple scattering of photons in the circumstellar dust envelope. Mass-loss rates are lower than the mass consumption rate by nuclear burning, $\dot{M}_{\rm nuc}$, for most of the RSGs. Two RSGs have $\dot{M} \gg \dot{M}_{\rm nuc}$, however, suggesting that RSGs shed most of their stellar mantles in short phases of intense mass loss. Stars on the thermal pulsing AGB may also experience episodes of intensified mass loss, but their quiescent mass-loss rates are usually already higher than $\dot{M}_{\rm nuc}$.

Accepted by Astronomy and Astrophysics Main Journal
Preprints can be obtained by contacting jacco@ast.cam.ac.uk

The Kinematics of Point-Symmetric Planetary Nebulae: Observational Evidence of Precessing Outflows

M. A. Guerrero[1]

[1] Astronomy Department, University of Illinois, 1002 W. Green Street, Urbana, IL 61801, USA

The discovery of collimated outflows associated to point-symmetric features in Planetary Nebulae has proliferated in recent years. The systematic variation of radial velocity that many of them show strongly suggests a uniform rotation or precession of the ejection direction. Although several physical processes have been invoked, the formation mechanism of precessing collimated outflows in PNe is currently an intriguing but unresolved problem.

To appear in Asymmetrical Planetary Nebulae II: from Origins to Microstructures, ASP Conference Series, J.H. Kastner, N. Soker, & S.A. Rappaport, eds.

Preprints can be obtained by contacting mar@astro.uiuc.edu *or via WWW on* http://www.astro.uiuc.edu/~mar/

A homogeneous study of the s-process in the 21 μm carbon-rich post-AGB objects.

Hans Van Winckel[1] *and Maarten Reyniers*[1]

[1] Instituut voor Sterrenkunde, K.U.Leuven, Celestijnenlaan 200B, 3001 Leuven (Heverlee).

We present in this paper a homogeneous photospheric abundance study, on the basis of the analysis of high resolution optical spectra, of six post-AGB objects displaying a 21 μm circumstellar dust feature in their IR spectrum. The F-G spectral type of the 21 μm stars make that a large range of elements including a wide variety of s-process elements, can be studied by their atomic lines. The high C/O-ratios together with the large overabundance of s-process elements prove that the objects are descendants of field carbon stars. We discuss in detail the s-process abundance distribution displayed by these 21 μm stars and conclude that the 3rd dredge-up efficiency is closely related to the strength of the integrated neutron irradiation. The expected anti-correlation of the neutron irradiation with metallicity, on the other hand, contains a large *intrinsic* scatter. Finally we compare our results with other intrinsic and extrinsic s-process enriched objects and conclude that the post-AGB stars offer very useful complementary data to constrain the evolutionary models of AGB nucleosynthesis and dredge-up processes.

Accepted by A&A

Preprints can be obtained by contacting Hans.VanWinckel@ster.kuleuven.ac.be *or via WWW on*

http://www.ster.kuleuven.ac.be/homepage/publications.html

The kinematics of NGC 4361, a population II planetary nebula with a bipolar outflow

R. Vázquez,[1,2]*, J. A. López,*[2]*, L. F. Miranda,*[1]*, J. M. Torrelles,*[3,1]*, & J. Meaburn*[4]

[1] Instituto de Astrofísica de Andalucía, CSIC, Apdo. Postal 3004, 18080 Granada, Spain

[2] Instituto de Astronomía, UNAM, Apdo. Postal 877, 22800 Ensenada, B. C., Mexico

[3] Institut d'Estudis Espacials de Catalunya (IEEC/CSIC) Edifici Nexus, C/ Gran Capitá 2-4, E-08034 Barcelona, Spain

[4] Department of Physics and Astronomy, University of Manchester, Oxford Rd., Manchester M13 9PL, England, UK

High resolution, spatially resolved profiles of Hα, He II λ6560 Å and [O III] λ5007 Å and deep narrow band CCD images in the Hα and [O III] λ5007 Å emission lines have been obtained of the planetary nebula (PN) NGC 4361. In addition, VLA-DnC λ3.6-cm continuum observations are presented. This material allows to explore in unprecedented detail the morphology and kinematics of this PN. The morphology is altogether complicated given the highly filamentary structure of the envelope, which is confirmed to posses a low mass. The halo has a high expansion velocity that yields incompatible kinematic and evolutionary ages, unless previous acceleration of the nebular expansion is considered. However, the most remarkable result from the present observations is the detection of a bipolar outflow in NGC 4361, which is unexpected in a PN with a population II, low-mass core, progenitor. It is shown that shocks resulting from the interaction of the bipolar outflow with the outer shell are able to provide an additional heating source in this nebula.

Accepted by MNRAS. 1999.

Preprints can be obtained by contacting vazquez@bufadora.astrosen.unam.mx

NGC 6153: a super-metal-rich planetary nebula?

X.-W. Liu[1], *P. J. Storey*[1], *M. J. Barlow*[1], *I. J. Danziger*[2], *M. Cohen*[3] *and M. Bryce*[4]

[1] Department of Physics and Astronomy, University College London, Gower Street, London WC1E 6BT, UK
[2]Osservatorio Astronomico di Trieste, Via G. B. Tiepolo 11, I-34131 Trieste, Italy
[3]Radio Astronomy Laboratory, 601 Campbell Hall, University of California, Berkeley, CA 94720, USA
[4]Dept. of Physics & Astronomy, University of Manchester, Oxford Road, Manchester M13 9PL, UK

We have obtained deep optical spectra of the planetary nebula NGC 6153, both along its minor axis and by uniformly scanning a long slit across the whole nebula. The scanned spectra when combined with the nebular total Hβ flux yield integrated fluxes for all the lines ($\sim$ 400) in our spectra, which are rich in strong recombination lines from C, N, O and Ne ions. A weak O VI λ3811 emission line from the central star has been detected, suggesting that the nucleus of NGC 6153 has a hydrogen-deficient surface. The optical data, together with the ISO LWS 43–197μm spectrum and the archival IUE and IRAS LRS spectra, have been used to study the thermal and density structure and to derive the heavy element abundances from lines produced by different excitation mechanisms. In all cases, the C^{2+}/H^+, N^{2+}/H^+, O^{2+}/H^+ and Ne^{2+}/H^+ abundances derived from multiple optical recombination lines (ORLs) are consistently higher, by about a factor of ten, than the corresponding values deduced from optical, UV or infrared collisionally excited lines (CELs), regardless of the excitation energies or critical densities of the latter. The agreement between the temperature-sensitive optical forbidden lines and the temperature-insensitive IR fine-structure lines rules out temperature fluctuations as the cause of the large difference between the ORL and CEL abundances.

We present the results of a new calculation of recombination coefficients for [O II] which lead to good agreement between the observed and predicted [O II] $\lambda\lambda$7320, 7330 forbidden line intensities if these lines are solely excited by recombination at the Balmer jump temperature. Recombination excitation is also found to be important in exciting the [N II] λ5754 line, which, if unaccounted for, would lead to an overestimated [N II] temperature from the observed $(\lambda6548 + \lambda6584)/\lambda5754$ ratio. Analysis of a number of C II lines arising from levels as high as 7g in the recombination ladder reveals excellent agreement between their reddening-corrected relative intensities and those predicted by recombination theory. Spatial analysis of the long-slit spectra taken along the nebular minor-axis yields a varying [O III] temperature, whereas the hydrogen Balmer jump temperature of 6000 K is approximately constant across the nebula and is 2000–3000 K lower than the [O III] temperature. The observed high-n Balmer line decrement indicates that the hydrogen lines arise from material having an electron density of $2000^{+2000}_{-1000}\,\mathrm{cm}^{-3}$, consistent with the optical and IR forbidden-line density diagnostics, which yield average line-of-sight electron densities along the minor-axis varying between 2000–4000 cm^{-3}.

While the He/H ratio mapped by He I and He II recombination lines is constant within 5 per cent across the nebula, the C^{2+}/H^+ and O^{2+}/H^+ recombination-line abundances decrease by a factor of two to three over a radius of 15 arcsec from the centre, pointing to the presence of abundance gradients. We consider a variety of hypotheses to account for the observed behaviour of the various thermal, density and abundance diagnostics. Empirical nebular models containing two components with differing densities and temperatures are able to account for many of the observed patterns, but only if one of the components is significantly hydrogen-deficient. One such model, which gives a good fit to the observed line intensities and patterns, has 500 K H-depleted material, presumed to be evaporating from dense neutral inclusions, embedded in 9500 K material with 'normal' abundances. An alternative model, which appears more physically plausible on a number of grounds, has high-density (2×10^6 cm^{-3}), fully ionized, H-deficient knots embedded in the 'normal' component, although this model fails to adequately account for the observed low (6000 K) hydrogen Balmer-jump temperature. However, the observed fact that the ORLs and CELs yield heavy element abundance ratios that are identical within the uncertainties, finds no obvious explanation in the context of hydrogen-deficient knot models.

Accepted by MNRAS
For preprints, contact xwl@star.ucl.ac.uk

X-rays from Planetary Nebulae

You-Hua Chu[1], *Martín A. Guerrero*[1], *and Robert A. Gruendl*[1]

[1] Astronomy Department, University of Illinois, 1002 W. Green Street, Urbana, IL 61801, USA

Two sources of X-ray emission are expected from planetary nebulae: the hot central stars with $T_{eff} > 10^5$ K, and shocked fast stellar winds at temperatures of $10^6 - 10^7$ K. The stellar emission and nebular emission differ in spatial distribution and spectral properties. Observations of X-ray emission from PNe may provide essential information on formation mechanisms and physical conditions of PNe. X-ray emission from PNe has been detected by *Einstein* and *EXOSAT*, but significant advances are made only after *ROSAT* became available. The *ROSAT* archive contains useful observations of ∼80 PNe, of which 13 are detected. Three types of X-ray spectra are seen. Only three PNe are marginally resolved by the *ROSAT* instruments. In the near future, *Chandra* will provide X-ray observations with much higher angular and spectral resolution, and help us understand the central stars as well as the hot interiors of PNe.

To appear in the proceedings of the workshop "Asymmetrical Planetary Nebulae II: From Origins to Microstructures"

Preprints can be obtained by contacting chu@astro.uiuc.edu *or via WWW on* http://xxx.lanl.gov/ps/astro-ph/9909106

Density and Excitation Mapping of M 2-9

J. P. Phillips[1] *and L. Cuesta*[2]

[1] Instituto de Astronomía y Meteorología, Avenida Vallarta 2602, Col. Arcos Vallarta, C.P. 44130 Guadalajara, Jalisco, Mexico; e-mail: jpp@udgserv.cencar.udg.mx

[2] Instituto de Astrofísica de Canarias, La Laguna, 38200-Tenerife, Spain; e-mail: lcc@ll.iac.es

We have acquired imaging of the bipolar outflow M 2-9 in the transitions [OIII] λ 5007 Å, HI λ 6563 Å, [NII] λ 6584 Å and [SII] $\lambda\lambda$ 6717+6731 Å. As a result, we are able to map both excitation and density over the face of the nebula. We find that underlying densities in the lobes increase to $n_e \sim 1.6\ 10^3$ cm^{-3} at distances $r_p \sim 12 \rightarrow 15$ arcsec from the central star, after which they again decrease to $n_e < 200$ cm^{-3} for $r_p > 27$ arcsec. Superimposed upon this are various density knots, associated with the visual condensations, in which peak values of n_e are of order $6.3\ 10^3$ cm^{-3}. These appear to be responsible for low-excitation shadowing of the outer envelope.

All of these features (the density peaks, and broad underlying density variation) are shown to be consistent with a particular model of shock excitation, in which an interior wind is shock interacting with an external neutral envelope.

Such a model appears also to be consistent with trends in [OIII]/Hα and [SII]/Hα, which (for the northern lobe at least) appear most consistent with shock excitation.

Accepted by Astronomical JournalAccepted by Astronomical Journal

Preprints can be obtained by contacting lcc@ll.iac.es

or via WWW on http://www.iac.es/publicaciones/preprints.html

or via anonnymous ftp on ftp://ftp.iac.es/pub/research/preprints/PP5599.tar.gz

The Structure of NGC 2392

J. P. Phillips[1] *and L. Cuesta*[2]

[1] Instituto de Astronomía y Meteorología, Avenida Vallarta 2602, Col. Arcos Vallarta, C.P. 44130 Guadalajara, Jalisco, Mexico; e-mail: jpp@udgserv.cencar.udg.mx

[2] Instituto de Astrofísica de Canarias, La Laguna, 38200-Tenerife, Spain; e-mail: lcc@ll.iac.es

The planetary nebula NGC 2392 possesses an extremely unusual spectro-kinematic morphology, characterised by several strange and elusive structures. In the following, extensive narrow band imaging of the source is used to investigate the shell excitation structure, while [OIII] and [SII] images are ratiod to provide fully sampled mapping of electron density and temperature. As a result, we are able to confirm the presence of low densities in the various filamentary structures; an appreciable radial decrease in density in the outer shell; and finally, a probable regime of higher shell densities at the interface of the bright inner shell, and lower intensity outer halo. Although temperatures are more uniform, we also find evidence for a significant temperature enhancement close to the inner/outer shell interface, and it is proposed that both anomalies (in density and temperature) arise in a post-shock cooling regime.

Finally, present imaging and prior spectroscopy are used to construct a revised model of the source, in which it is argued that the outer filamentary structure occupies a disk-like regime, congruent with the principal plane of the outer spheroid. Individual filaments arise from low-excitation density contrasts, created through the interaction between the outer shell and a precessing jet.

Accepted by Astronomical Journal

Preprints can be obtained by contacting lcc@ll.iac.es

or via WWW on http://www.iac.es/publicaciones/preprints.html

or via anonnymous ftp on ftp://ftp.iac.es/pub/research/preprints/PP5499.tar.gz

Irregular variables of type Lb. Energy distributions and stellar parameters

F. Kerschbaum[1]

[1] Institut für Astronomie der Universität Wien, Türkenschanzstraße 17, A-1180 Wien, Austria

AGB variables of types Lb, SRa, SRb, and Mira are studied by fitting combinations of blackbodies to visual, near infrared and IRAS data. This paper supplements an earlier work dealing with a smaller sample of SRa and SRb variables. The fitted parameters T^*, $T^{\rm d}$ and R^d/R^* are related to physically meaningful quantities. Also, quantities derived from the fits like the ratio of the luminosities of the two fitted blackbodies are confronted with independent mass-loss estimators.

For the O-rich Lb variables all of the 'blue' objects can be reasonably well approximated by only one blackbody whereas the 'red' ones need two. Among the 'blue' objects a significant fraction seem to be not on the AGB at all but a kind of 'RGB pollution'. The T^* values, reflecting mainly offseted ($-500\,$K) effective temperatures for objects with small to moderate mass-loss, are significantly higher in the 'blue' cases.

Carbon-rich objects differ significantly from the O-rich ones in their fit parameters. Sometimes 'unphysically' low T^* are found – a result of circumstellar reddening in the high mass-loss cases. Furthermore lower values of $T^{\rm d}$, accompanied by normal T^*s and large shell radii are common and can be related to the phenomenon of detached shells. S-stars populate a similar region to the optically thin carbon stars in their fit properties.

Accepted by A&A

Preprints can be obtained by contacting kerschbaum@astro.univie.ac.at

Abstract of recently completed dissertations

Cosmic Dust and Late-Type Stars

Anja C. Andersen

Thesis work conducted at: Niels Bohr Institute for Astronomy, Physics and Geophysics, Faculty of Science, Copenhagen University, Denmark

Ph.D dissertation directed by: Uffe Gråe Jørgensen

Ph.D degree awarded: September 20, 1999

Current address: Astronomical Observatory, Juliane Maries Vej 30, DK-2100 Copenhagen, Denmark

Electronic mail: anja@astro.ku.dk

Dust play an important role in late stages of stellar evolution. In particular, it has a pronounced influence on the mass loss of late type giant stars and as such is one of the key factors in determining the evolution and fate of these objects. Therefore it is essential to understand basic dust properties and especially the optical properties of the dust grains which are expected to form in these type of stars is essential. This thesis is devoted to both, laboratory experiments to obtain some of the necessary basic dust properties and calculating theoretical atmospheric models with the obtained spectral properties of the grains included.

Two different dust types were studied in the laboratory; diamonds and silicon carbide. The spectral appearance of presolar diamond and silicon carbide extracted from meteoritic material was determined and compared to diamonds and silicon carbide produced in the laboratory in order to get a better understanding of some of the basic physical properties of these two types of presolar grains. The laboratory produced SiC samples was studied intensively to provide a good understanding of the influence of grain shape, sizes, crystal-types, impurities and the influence of using a matrix in the laboratory measurements.

The data obtained in the laboratory was used in two different theoretical atmospheric model calculations for carbon rich late-type stars: (1) A self-consistent hydrostatic photospheric model calculation with the diamond data included. It was found that although the diamonds should not be expected to show up in observed spectra of carbon stars, they never-the-less have a significant influence on the photospheric structure of the star. (2) A self-consistent hydrodynamic atmosphere model with some of the silicon carbide data included and which also used selected laboratory amorphous carbon data. In these particular models the mass loss rates are not severely dependent on the difference in the optical properties of the dust, but the influence on the degree of condensation and the final outflow velocity as well as on the synthetic colours is considerable.

Announcement

ASTRID DATABASE

ASTRID database is dedicated to stars in advanced evolutive stages

NEW

* Available data of NIR-survey DeNIS sources associated to

ASTRID objects are now included into the base

* A NEW more convivial WEB ACCESS is now running.

ASTRID address: http://www.graal.univ-montp2.fr , ASTRID e-mail: astrid@graal.univ-montp2.fr
Marie-Odile MENNESSIER and Michel Belmas,GRAAL, Univ. Montpellier II,F34095 Montpellier Cedex5 (France)