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Editorial

Introducing structured abstracts for A&A articles⋆

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ABSTRACT

Context. Due to their wide availability, abstracts have become the most important part of any astrophysical paper.
Aims. Having noticed that abstracts published in astronomical journals are not always optimal, we introduce the concept of structured abstracts for A&A articles.
Methods. We explain what structured abstracts are and where they come from, provide examples showing how to structure an abstract, and discuss the advantages and drawbacks of this novel concept. In an on-line appendix, we show what some published abstracts look like once they are structured.
Results. We demonstrate the improvements in information content, readability, and style that can be made when writing structured abstracts instead of traditional ones.
Conclusions. A new version 6.0 of the A&A LaTeX macro is now available for structuring the abstracts of articles, and A&A authors are kindly invited to use it for their new submissions.

Key words. Editorials

1. Introduction

Confronted with a huge volume of new information every week, researchers in the physical sciences can no longer read all the literature that is published on scientific matters that interest them. The paper's abstract, undoubtedly the most visible part of any scientific article, has therefore in recent years become particularly important as a *filter* for deciding what articles are worth taking the time to read in detail. This is particularly true for astrophysics articles, since the abstract is referenced and widely accessible in the *NASA Astrophysics Data Service*, in topical newsletters, and in other abstract databases.

Whether a colleague will read your paper or not thus depends in large measure on the level of interest that is gained from reading your paper's abstract. When writing it, one must therefore make sure that it conveys the essential elements of the article to the reader: its objective, the methods used to reach it, and the results obtained. This must be done in a concise yet informative way, without using external references that will not be referenced in the abstract databases. Finally, the style must be pleasing.

While editing A&A articles, we have become aware that the abstracts of published papers have not always fulfilled the criteria given above. Sometimes an abstract will be so concise and specialized that only the few people working in the paper's specific research field are able to understand the significance of results obtained by the author. At other times, the abstract goes into unnecessary detail and becomes much too unwieldy. We have also seen cases where the abstract does not reflect the paper's contents, either because some important results are not mentioned or because results presented in the abstract are not substantiated in the text of the paper. Of course, these extreme cases remain relatively rare, but we nonetheless concluded from studying a large number of A&A abstracts that in most cases, they could be written in a clearer and more informative way.

This is why we are introducing the concept of structured abstracts for A&A papers. The following will hopefully be able to convince you that the information content, readability, and style of your abstracts will be vastly improved by adopting the simple rules of structured abstracts, thereby increasing the impact of your articles.

⋆ Appendix A is only available in electronic form at `http://www.edpsciences.org`

2. What are structured abstracts?

As with a traditional abstract, a structured abstract summarizes the contents of the paper, but it also makes the structure of the article explicit and visible. To accomplish this, the structured abstract uses headings that define each of several short paragraphs and that reflect the particular needs of the discipline. For astronomy papers, we propose to use three mandatory paragraphs as the core of the structured abstract, entitled, respectively, *Aims*, *Methods*, and *Results*. When appropriate, the structured abstract may use an introductory paragraph entitled *Context*, and a final paragraph entitled *Conclusions*. While these headings are self-explanatory, one should emphasize that there is no redundancy between them. For example, the *Aims* paragraph describes the objectives of the paper, while *Context* explains the reasons for the current investigation and may give background. Similarly, *Results* summarizes the results found in the paper, while *Conclusions* explains the significance of the results in a more general framework.

In addition, the abstract should accurately summarize the paper's contents, be limited to 300 words, and be self-contained (no references, abbreviations, or acronyms, except for the truly obvious and familiar ones).

3. Where do structured abstracts come from?

The general idea of a structured abstract was apparently first discussed by Ertl (1969) in a Swiss publisher's trade newspaper. Ertl proposed to publish abstracts in a tabular form, arguing that this format would force the authors to write more informative abstracts. The paper was noticed by Dr. Edward J. Huth, who later became the Editor of *Annals of Internal Medicine*, and he discussed it with Dr. R. Brian Hugues, an influential member of the *Ad Hoc Working Group for Critical Appraisal of the Medical Literature*. The working group did not retain Ertl's tabular format but proposed to introduce structured abstracts in the form described above for clinical articles (*Ad Hoc Working Group for Critical Appraisal of the Medical Literature* 1987).

Although structured abstracts are now mandatory in most medical research journals and are also successfully used in the social sciences, they have so far attracted little attention in the physical sciences. We note, however, that the astronomical community already uses structured documents, such as the well-known *ESO Observing Proposal*. Many other observing and grant proposal formats make use of structured contents, so the principle is not new to astronomers.

4. Two examples of structured abstracts

The best way to demonstrate how structured abstracts look is to give examples. The first one is for a recent observational paper in the field of stellar astronomy authored by Appenzeller et al. (2005) and entitled "Edge-on T Tauri stars."

Aims. We study the optical spectral properties of three young stellar objects with edge-on circumstellar disks HH30*, HK Tau B, and HV Tau C and compare them to other classical T Tauri stars.

Methods. We used the ESO VLT UVES echelle spectrograph to obtain two-dimensional high-resolution (R = 50 000) spectra. The observed wavelength range extends from 3280 to 4490 Å in the blue channel and from 4726 to 6722 Å in the red channel, with a gap from 5708 to 5817 Å. For comparison purposes, we also observed both the classical T Tauri star HL Tau and the active late-type star LDN 1551-9.

Results. The spectra of all three disks observed edge-on consist of a T Tauri emission and absorption line spectrum with superimposed jet emission lines. Analysis of the spectra confirmed that the disks are completely opaque at visible wavelengths and that light from the central objects reaches us only via scattering layers above and below the disk planes. The central objects of our targets are found to be normal T Tauri stars showing moderate but different amounts of veiling of their photospheric spectra, indicating different accretion rates or evolutionary stages. Part of the jet emission from edge-on systems is directly visible to us in the forbidden lines, as well as in Hα and He I, a finding which contradicts the present paradigm of a pure magnetospheric accretion origin for the formation of hydrogen and helium emission lines in moderately active classical T Tauri stars. We discuss the various possible formation regions for the Na I D lines and show that profiles similar to observed ones can be formed at the base of the disk wind.

Conclusions. We suggest that all classical T Tauri stars show the morphology observed here when viewed edge-on. From a comparison with those Taurus-Auriga classical T Tauri stars for which the inclination is reliably known, we conclude that the view angle is one of the key parameters governing apparent Hα emission strength in the T Tauri class.

As a second example, we consider a structured abstract for a theoretical paper in cosmology entitled "Galaxy-galaxy-galaxy lensing: Third-order correlations between the galaxy and mass distributions in the Universe" (Schneider & Watts 2005).

Context. Galaxy-galaxy lensing measures the 2-point cross-correlation between galaxies and mass in the Universe.

Aims. In this work we seek to generalise this effect by considering the *third-order* correlations between galaxies and mass: galaxy-galaxy-galaxy lensing. Third-order correlations in the cosmic shear field have recently been reported in the VIRMOS-DESCART and CTIO surveys. Such data should also be ideal for measuring galaxy-galaxy-galaxy lensing. Indeed, the effects of

these higher-order correlations may have already been detected in recent studies of galaxy-galaxy lensing. Higher-order cross-correlation functions contain invaluable information about the relationship between galaxies and their mass environments, which galaxy-galaxy lensing studies alone cannot detect.

Methods. We lay out the basic relations for third-order cross correlations and their projections and introduce a new set of scale dependent third-order bias parameters.

Results. Third-order galaxy-mass cross-correlations are described by three new observables: two galaxy-shear-shear correlation functions, $G_{\pm}$, and a galaxy-galaxy-shear correlation, $\mathcal{G}$. We derive their relation to the various projected cross-bispectra and give practical estimators for their measurement. The observational signature of these correlators is simply the excess shear-shear correlation measured about foreground galaxies (for $G_{\pm}$) and the average tangential shear around foreground galaxy pairs (for $\mathcal{G}$). These quantities are no more than second order in the shear and so should be more easily measurable than the shear 3-point correlation. Finally we derive expressions for the third-order aperture mass statistics in terms of both the cross-bispectra and the real-space correlation functions.

Conclusions. The third-order aperture statistics provide a very localized measurement of the bispectra, thus essentially encapsulating all of the available third-order information, while remaining easily obtainable from observations of 3-point cross-correlation functions. In addition we find that utilising aperture statistics has the further benefit of measuring only the *connected* part of the third-order correlation.

Compared to their original counterparts, the two structured abstracts above are slightly more detailed, particularly in describing the aims and methods, and thus somewhat longer. The acronyms ESO, VLT, UVES, VIRMOS-DESCART, and CTIO are reasonably well-known and thus acceptable. In contrast, the acronym CTTS for "classical T Tauri star" or GGL for "galaxy-galaxy lensing," which were used in the original abstracts, were not kept in the structured versions because they are not widely known outside of the respective communities working in these fields. The basic guideline here is to aim for accessibility of the abstract's contents to a broad readership among professional astronomers.

In Appendix A, available in the on-line version of this editorial, we display randomly selected abstracts published in A&A and structure them without trying to improve on the information content of the original abstract. This exercise demonstrates both the strengths and weaknesses of the original abstracts and how structuring them can lead to vast improvements with little additional effort on the author's part.

5. Pros and cons of structured abstracts

As noted, e.g., by Hartley (1998; see also references therein), comparative studies of traditional and structured abstracts have shown that structured abstracts

- are of a higher quality;
- contain more information;
- are easier to search and to read;
- facilitate peer-review;
- are generally welcomed by both readers and authors.

The higher quality level reflects how structured abstracts summarize the work in a more accurate and complete way than traditional abstracts. They contain more information because the headings force authors to name the various aspects of their works more precisely. The consistent format makes them easier to search and to read. Since after reading the abstract the referee knows precisely what (s)he will find in the paper, evaluation is easier. Finally, structured abstracts are not more difficult to write than traditional ones – in fact, it can be argued that the writing is facilitated by the presence of headings – and they increase the visibility of the paper's contents, thus benefitting authors and readers alike.

Like their traditional counterparts, structured abstracts will of course be referenced in the community's popular preprint servers such as the *NASA Astrophysics Data Service*. We have checked with *ADS* that the new format will not cause any difficulties and that the paragraph headings proposed above will not interfere with the preprint servers' search functions.

The drawbacks of structured abstracts compared to traditional abstracts are as follows. Structured abstracts:

- are longer;
- are still sometimes prone to the same sorts of errors of omission and distortion as are traditional abstracts.

The increased length of structured abstracts evidently reflects the fact that they are more informative than traditional ones. That omission and distortions are still found in some structured abstracts is probably unavoidable. The important point, however, is that structured abstracts make it easier for authors to give an accurate and complete summary of their work.

Clearly, the advantages of structured abstracts outweigh their drawbacks, which explains their success in the scientific journals that have adopted them.

6. Implementing structured abstracts in A&A

In view of the arguments given above and of a study of published abstracts presented partly in Appendix A, we became convinced that introducing structured abstracts in A&A would be of great benefit to the authors, readers, and referees of the Journal. We thus studied with the publisher how we could introduce structured abstracts in the A&A LaTeX macro, and chose a suitable style. As it turned out, the expected increased length of structured abstracts can be approximately offset by increasing the abstract's width to the full journal page width (see the abstract of this editorial), so that we do not expect adverse effects on the number of published pages.

During its latest meeting, which took place on May 6-7, 2005 in Tenerife, the Board of A&A Directors supported this initiative and decided to introduce structured abstracts in the Journal *on a voluntary basis*. One year after introduction, the community's reactions and the advantages and drawbacks of structured abstracts will be reviewed. We therefore strongly encourage you to make use of this new feature and to send us your feedback as authors and readers of A&A.

The new A&A LaTeX macro (version 6.0), which takes the rules for structured abstracts into account, is available at `http://www.edpsciences.org/aa`. It includes in particular the abstract's headings, which are the five arguments of the new **\abstract** command. Only the first and last arguments, which correspond to headings *Context* and *Conclusions*, can be left empty. The new macro also includes a counter for the number of words in the abstract (up to 300 words are allowed) and an error message reminding the authors that they cannot use references within the abstracts.

Acknowledgements. We are indebted to the colleagues who allowed us to use their published abstracts to demonstrate the benefits of writing structured abstracts.

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Online Material

Appendix A: Structuring abstracts in various astronomy subfields

We present here ten randomly chosen abstracts of papers published in various subfields of astronomy in the last two years. We structured them according to the principles described in Sect. 2, but *did not try to improve the information content of the original abstracts.* Note that the original abstracts used here are those of the original submissions, language-edited for this editorial, so that there may be slight differences from the published original.

A.1. Cosmology and extragalactic astronomy

A.1.1. Double-Barred Galaxies: I. A Catalog of barred galaxies with secondary bars and inner disks

Original Abstract

I present a catalog of 67 barred galaxies which contain distinct, elliptical stellar structures inside their bars. Fifty of these are double-barred galaxies: a small-scale, *inner* or *secondary* bar is embedded within a large-scale, *outer* or *primary* bar. I provide homogenized measurements of the sizes, ellipticities, and orientations of both inner and outer bars, along with global parameters for the galaxies. The other 17 are classified as *inner-disk* galaxies, where a large-scale bar harbors an inner elliptical structure, which is aligned with the galaxy's outer disk. Four of the double-barred galaxies also possess inner disks, located between the inner and outer bars. While the inner-disk classification is ad-hoc – and undoubtedly includes some inner bars with chance alignments (five such probable cases are identified) – there is good evidence that inner disks form a statistically distinct population, and that at least some are indeed disks rather than bars. In addition, I list 36 galaxies which *may* be double-barred, but for which current observations are ambiguous or incomplete, and another 23 galaxies that were previously considered to be potentially double-barred but that are probably *not*. False double-bar identifications are usually due to features such as nuclear rings and spirals being misclassified as bars; I provide some illustrated examples of how this can happen.

A detailed statistical analysis of the general population of double-bar and inner-disk galaxies, as represented by this catalog, will be presented in a companion paper.

Structured Abstract

Aims. I present a catalog of 67 barred galaxies which contain distinct, elliptical stellar structures inside their bars. In addition, I list 36 galaxies which *may* be double-barred, but for which current observations are ambiguous or incomplete, and another 23 galaxies that were previously considered to be potentially double-barred but that are probably *not*.

Methods. [not described in the original abstract]

Results. Fifty of the 67 barred galaxies are double-barred: a small-scale, *inner* or *secondary* bar is embedded within a large-scale, *outer* or *primary* bar. I provide homogenized measurements of the sizes, ellipticities, and orientations of both inner and outer bars, along with with global parameters for the galaxies. The other 17 are classified as *inner-disk* galaxies, where a large-scale bar harbors an inner elliptical structure which is aligned with the galaxy's outer disk. Four of the double-barred galaxies also possess inner disks, located between the inner and outer bars. While the inner-disk classification is ad-hoc – and undoubtedly includes some inner bars with chance alignments (five such probable cases are identified) – there is good evidence that inner disks form a statistically distinct population, and that at least some are indeed disks rather than bars. False double-bar identifications are usually due to features such as nuclear rings and spirals being misclassified as bars; I provide some illustrated examples of how this can happen.

Conclusions. A detailed statistical analysis of the general population of double-bar and inner-disk galaxies, as represented by this catalog, will be presented in a companion paper.

Comments

Aims and results were mixed together in the original abstract, making it harder to follow than a structured counterpart would be. The methods of investigation were also not given.

A.1.2. Nuclear star formation in NGC 6240

Original Abstract

We made use of archival HST BVIJH photometry to constrain the nature of the three discrete sources, A1, A2, and B1, identified in the doublenucleus of NGC 6240. STARBURST99 models were fitted to the observed colours under the assumption, first, that these sources can be treated as star clusters (i.e. single, instantaneous episodes of star formation), and subsequently as star-forming regions (i.e. characterised by continuous star formation). For both scenarios, we estimated the ages as young as 4 million years, integrated masses ranging between 7×10^6 $M_\odot$ (B1) and 10^9 $M_\odot$ (A1), and a rate of 1 supernova per year, which together with the stellar winds, sustains a galactic wind of 44 $M_\odot$ yr^{-1}. In the case of continuous star formation, a star-formation rate was derived for A1 as high as 270 $M_\odot$ yr^{-1}, similar to what is observed for warm Ultraluminous Infrared Galaxies (ULIRGs) with a double nucleus. The A1 source is characterised by a mass density of about 1200 $M_\odot$ pc^{-3}, which resembles the CO molecular mass density measured in cold ULIRGs and the stellar density determined in "elliptical core" galaxies. This, together with the recent discovery of a supermassive binary black hole in the double nucleus of NGC 6240, might indicate that the ongoing merger could shape the galaxy into an elliptical core.

Structured Abstract

Aims. We constrain the nature of the three discrete sources, A1, A2, and B1, identified in the double nucleus of NGC 6240.

Methods. We used archival HST BVIJH photometry and fitted STARBURST99 models to the observed colours under the assumption that these sources can be treated either (a) as star clusters (i.e. single, instantaneous episodes of star formation) or (b) as star-forming regions (i.e. characterised by continuous star formation).

Results. For both scenarios, we estimated ages as young as 4 million years, integrated masses ranging between 7×10^6 $M_\odot$ (B1) and 10^9 $M_\odot$ (A1) and a rate of 1 supernova per year, which together with the stellar winds, sustains a galactic wind of 44 $M_\odot$ yr^{-1}. In the case of continuous star formation, a star-

formation rate was derived for A1 as high as 270 $M_\odot$ yr^{-1}, similar to what is observed for warm Ultraluminous Infrared Galaxies (ULIRGs) with a double nucleus. The A1 source is characterised by a mass density of about 1200 $M_\odot$ pc^{-3}, which resembles the CO molecular mass density measured in cold ULIRGs and the stellar density determined in "elliptical core" galaxies.

Conclusions. Our results, together with the recent discovery of a supermassive binary black hole in the double nucleus of NGC 6240, might indicate that the ongoing merger could shape the galaxy into an elliptical core.

Comments

The original abstract was well organized, but the methods are more clearly defined in the structured version.

A.1.3. Spectral characteristics of water megamaser galaxies II

Original Abstract

Long-slit optical emission-line spectra of the megamaser galaxies ESO 1030G035, TXS 2226-184, and IC 1481 are evaluated in order to look for characteristics that are typical of water-megamaser galaxies. We present rotation curves, line ratios, electron densities, temperatures, and Hβ luminosities. The successful line-profile decompositions rest on d-Lorentzians with an additional parameter d to adjust the wings, rather than Gaussians or Lorentzians as basic functions. On the basis of line ratios and its low luminosity, TXS 2226-184 is classified as a LINER (low-ionization nuclear emission-line region). IC 1481 reveals a spectrum suggestive of a vigorous starburst in the central kiloparsec 10^8 years ago. We do not find any hints of outflows or of any special features which could give clues to the unknown megamaser excitation mechanism. All three galaxies are of normal Seyfert-2 or LINER type.

Structured Abstract

Aims. We look for characteristics that are typical of water-megamaser galaxies in ESO 1030G035, TXS 2226-184, and IC 1481.

Methods. We obtained long-slit optical emission-line spectra.

Results. We present rotation curves, line ratios, electron densities, temperatures, and Hβ luminosities. The successful line-profile decompositions rest on d-Lorentzians with an additional parameter d to adjust the wings, rather than Gaussians or Lorentzians as basic functions. On the basis of line ratios and its low luminosity, TXS 2226-184 is classified as a LINER (low-ionization nuclear emission-line region). IC 1481 reveals a spectrum suggestive of a vigorous starburst in the central kiloparsec 10^8 years ago.

Conclusions. We do not find any hints of outflows or any special features which could give clues to the unknown megamaser excitation mechanism. All three galaxies are of normal Seyfert-2 or LINER type.

Comments

The original abstract is informative and well organized. Its only weakness is in the description of the methods, which appears too brief.

A.1.4. The Tully-Fisher Relation at intermediate redshift

Original Abstract

Using the Very Large Telescope in Multi-Object Spectroscopy mode, we observed a sample of 113 field spiral galaxies in the FORS Deep Field (FDF) with redshifts in the range $0.1 < z < 1.0$. The galaxies were selected by apparent brightness ($R < 23^m$), and they encompass all late spectrophotometric types from Sa to Sdm/Im. Spatially resolved rotation curves were extracted for 77 galaxies and fitted with synthetic velocity fields taking all observational effects into account from inclination and slit misalignment to seeing and slit width. We also compared different shapes for the intrinsic rotation curve. To gain robust values of $V_{\rm max}$, our analysis was focused on galaxies with rotation curves which extend well into the region of constant rotation velocity at large radii. If the slope of the local Tully-Fisher relation (TFR) is held fixed, we find evidence of a mass-dependent luminosity evolution which is as large as up to $\Delta M_B \approx -2^m$ for the lowest-mass galaxies, but which is small or even negligible for the highest-mass systems in our sample. Actually, the TFR slope is shallower at $z \approx 0.5$ compared to the local sample. We argue for a mass-dependent evolution of the mass-to-light ratio. An additional population of blue, low-mass spirals does not seem a very appealing explanation. The flatter tilt we find for the distant TFR contradicts predictions of recent semi-analytic simulations.

Structured Abstract

Aims. We observed a sample of 113 field spiral galaxies in the FORS Deep Field (FDF) with redshifts in the range $0.1 < z < 1.0$ *[in order to...]*. The galaxies were selected upon apparent brightness ($R < 23^m$) and encompass all late spectrophotometric types from Sa to Sdm/Im.

Methods. Spatially resolved rotation curves were extracted from VLT spectra obtained in Multi-Object Spectrocopy mode for 77 galaxies and fitted with synthetic velocity fields taking all observational effects into account from inclination and slit misalignment to seeing and slit width. We also compared different shapes for the intrinsic rotation curve. To gain robust values of $V_{\rm max}$, our analysis was focused on galaxies with rotation curves which extend well into the region of constant rotation velocity at large radii.

Results. If the slope of the local Tully-Fisher relation (TFR) is held fixed, we find evidence of a mass-dependent luminosity evolution, which is as large as up to $\Delta M_B \approx -2^m$ for the lowest-mass galaxies, but which is small or even negligible for the highest-mass systems in our sample. Actually, the TFR slope is shallower at $z \approx 0.5$ compared to the local sample. We argue for a mass-dependent evolution of the mass-to-light ratio. An additional population of blue, low-mass spirals does not seem a very appealing explanation. The flatter tilt we find for the distant TFR contradicts predictions of recent semi-analytic simulations.

Comments

As the objective of observations is not made explicit in the original abstract, the *Aims* paragraph appears incomplete.

A.2. Stellar Physics

A.2.1. Study of molecular layers in the atmosphere of the supergiant star μ Cep by interferometry in the K band

Original Abstract

Infrared interferometry of supergiant and Mira stars has recently been reinterpreted as revealing the presence of deep molecular layers. Empirical models for a photosphere surrounded by a simple molecular layer or envelope have led to a consistent interpretation of previously inconsistent data. The stellar photospheres are found to be smaller than previously understood, and the molecular layer is much higher and denser than predicted by hydrostatic equilibrium. However, this analysis was based on spatial observations with medium-band optical filters, which mixed the visibilities of different spatial structures. This paper reports spatial interferometry with narrow spectral bands that isolate near-continuum and strong molecular features, obtained for the supergiant μ Cep. The measurements confirm strong variation in apparent diameter across the K-band. A layer model shows that a stellar photosphere of angular diameter 14.11 ± 0.60 mas is surrounded by a molecular layer of diameter 18.56 ± 0.26 mas, with an optical thickness varying from nearly zero at 2.15 μm to > 1 at 2.39 μm. Although μ Cep and α Ori have a similar spectral type, interferometry shows that they differ in their radiative properties. Comparison with previous broad-band measurements shows the importance of narrow spectral bands. The molecular layer or envelope appears to be a common feature of cool supergiants.

Structured Abstract

Context. Infrared interferometry of supergiant and Mira stars has recently been reinterpreted as revealing the presence of deep molecular layers. Empirical models for a photosphere surrounded by a simple molecular layer or envelope have led to a consistent interpretation of previously inconsistent data. The stellar photospheres are found to be smaller than previously understood, and the molecular layer is much higher and denser than predicted by hydrostatic equilibrium. However, previous analysis was based on spatial observations with medium-band optical filters, which mixed the visibilities of different spatial structures.

Aims. This paper reports on narrow-band interferometric measurements obtained for the supergiant μ Cep.

Methods. We performed spatial interferometry with narrow spectral bands that isolate near-continuum and strong molecular features.

Results. The measurements confirm strong variation in apparent diameter across the K-band. A layer model shows that a stellar photosphere of angular diameter 14.11 ± 0.60 mas is surrounded by a molecular layer of diameter 18.56 ± 0.26 mas, with an optical thickness varying from nearly zero at 2.15 μm to > 1 at 2.39 μm. Although μ Cep and α Ori have a similar spectral type, interferometry shows that they differ in their radiative properties.

Conclusions. Comparison with previous broad-band measurements shows the importance of narrow spectral bands. The molecular layer or envelope appears to be a common feature of cool supergiants.

Comments

A well-organized, informative original abstract. The usefulness of the *Context* paragraph is apparent here. Aims and methods were not separated in the original text, which was nevertheless quite clear.

A.2.2. Abundances in giant stars of the globular cluster NGC 6752

Original Abstract

We present elemental abundance ratios [X/Fe] for 20 elements in 38 bright giants of the globular cluster NGC 6752 based on high-resolution, high signal-to-noise spectra obtained with UVES on the VLT. This is the most complete spectroscopic analysis of this cluster in terms of the number of elements considered and the number of stars in the sample. The stars span more than 1000K in effective temperature and more than 3 visual magnitudes along the red giant branch. None of the abundance ratios [X/Fe] show a correlation with evolutionary status. For Si and heavier elements, the small scatter in [X/Fe] may be attributable to the measurement uncertainties. Our mean abundance ratios [X/Fe] are in good agreement with previous studies of this cluster and are also consistent with other globular clusters and field stars at the same metallicity. The mean abundance ratios [Ba/Eu] and [La/Eu] exhibit values, in agreement with field stars at the same metallicity, which lie approximately midway between the pure *r*-process and the solar (*s*-process + *r*-process) mix indicating that AGB stars have played a role in the chemical evolution of the proto-cluster gas.

For the first time, we find possible evidence of an abundance variation for elements heavier than Al in this cluster. We find a correlation between [Si/Fe] and [Al/Fe] which is consistent with the abundance anomalies being synthesized via proton captures at high temperatures. Leakage from the Mg-Al chain into ^{28}Si may explain the Si excess in stars with the highest [Al/Fe]. We identify correlations between [Y/Fe] and [Al/Fe], [Zr/Fe] and [Al/Fe], and [Ba/Fe] and [Al/Fe], suggesting that Y, Zr, and Ba abundances may increase by about 0.1 dex as Al increases by about 1.3 dex. While the correlations are statistically significant, the amplitudes of the variations are small. Recent theoretical yields and chemical evolution models demonstrate that intermediate-mass AGB stars cannot reproduce the observed abundance distributions of O, Na, Mg, and Al. If the small variations in Y, Zr, and Ba are indeed real, then synthesis of the Al anomalies must have taken place within an unknown class of stars that also ran the *s*-process.

Structured Abstract

Context. Recent theoretical yields and chemical evolution models demonstrate that intermediate-mass AGB stars cannot reproduce the observed abundance distributions of O, Na, Mg, and Al.

Aims. As a further observational test of this finding, we present elemental abundance ratios [X/Fe] for 20 elements in 38 bright giants of the globular cluster NGC 6752. This is the most complete spectroscopic analysis of this cluster in terms of the num-

ber of elements considered and the number of stars in the sample. The stars span more than 1000K in effective temperature and more than 3 visual magnitudes along the red giant branch.
Methods. We obtained high-resolution, high signal-to-noise spectra with UVES on the VLT.
Results. None of the abundance ratios [X/Fe] show a correlation with evolutionary status. For Si and heavier elements, the small scatter in [X/Fe] may be attributable to the measurement uncertainties. Our mean abundance ratios [X/Fe] are in good agreement with previous studies of this cluster and are also consistent with other globular clusters and field stars at the same metallicity. The mean abundance ratios [Ba/Eu] and [La/Eu] exhibit values, in agreement with field stars at the same metallicity, which lie approximately midway between the pure *r*-process and the solar (*s*-process + *r*-process) mix, indicating that AGB stars have played a role in the chemical evolution of the proto-cluster gas. For the first time, we find possible evidence of an abundance variation for elements heavier than Al in this cluster. We find a correlation between [Si/Fe] and [Al/Fe] which is consistent with the abundance anomalies being synthesized via proton captures at high temperatures. Leakage from the Mg-Al chain into ^{28}Si may explain the Si excess in stars with the highest [Al/Fe]. We identify correlations between [Y/Fe] and [Al/Fe], [Zr/Fe] and [Al/Fe], and [Ba/Fe] and [Al/Fe], suggesting that Y, Zr, and Ba abundances may increase by about 0.1 dex as Al increases by about 1.3 dex. While the correlations are statistically significant, the amplitudes of the variations are small.
Conclusions. If the small variations in Y, Zr, and Ba are indeed real, then synthesis of the Al anomalies must have taken place within an unknown class of stars that also ran the *s*-process.

Comments

The motivation for doing this work was hidden deep in the original abstract. It is now prominent in *Context*. It would be useful to develop *Methods* further, while the results could be presented more concisely.

A.2.3. Characterising stellar micro-variability for planetary transit searches

Original Abstract

A method for simulating light curves containing stellar micro-variability is presented for a range of spectral types and ages. It is based on parameter-by-parameter scaling of a multi-component fit to the solar irradiance power spectrum (itself based on VIRGO/PMO6 data) and on scaling laws derived from ground-based observations of various stellar samples. A correlation was observed in the Sun between the amplitude of the power spectrum on long (weeks) timescales and the BBSO Ca II K-line index of chromospheric activity. From this evidence, the chromospheric activity level, as predicted from rotation period and B-V colour estimates according to the relationship first introduced by Noyes (1983) and Noyes et al. (1984), was used to predict the variability power on a time scale of weeks. The rotation period was estimated using a fit to the distribution of rotation period versus B-V observed in the Hyades and the Skumanich (1972) spin-down law. The characteristic timescale of the variability was also scaled according to the rotation period. The model was used to estimate the impact of the target star spectral type and age on the detection capability of space-based transit searches such as Eddington and Kepler. K stars are found to be the most promising targets, while the performance drops significantly for stars earlier than G and younger than 2.0 Gyr. Simulations also show that Eddington should detect terrestrial planets orbiting solar-age stars in most of the habitable zone for G2 types and in all of it for K0 and K5 types.

Structured Abstract

Aims. A method for simulating light curves containing stellar micro-variability is presented for a range of spectral types and ages. We then estimate the impact of the target star spectral type on the detection capability of space-based transit searches such as Eddington or Kepler.
Methods. The analysis is based on parameter-by-parameter scaling of a multi-component fit to the solar irradiance power spectrum (based on VIRGO/PMO6 data). Scaling laws were derived from ground-based observations of various stellar samples. For example, we established a correlation in the Sun between the amplitude of the power spectrum on long (weeks) timescales and the BBSO Ca II K-line index of chromospheric activity. From this evidence, the chromospheric activity level, predicted from rotation period and B-V colour estimates, was used to predict the variability power on a time scale of weeks. The rotation period was estimated using a fit to the distribution of rotation period versus B-V observed in the Hyades and the Skumanich spin-down law. The characteristic timescale of the variability was also scaled according to the rotation period.
Results. K stars were found to be the most promising targets for these transit searches, while the performance drops significantly for stars earlier than G and younger than 2.0 Gyr. Simulations also show that Eddington should detect terrestrial planets orbiting solar-age stars in most of the habitable zone for G2 types and all of it for K0 and K5 types.

Comments

The aims of the investigation are more readily apparent in the structured version of the abstract. Unnecessary references appearing in the original abstract were deleted.

A.3. Planets and planetary systems

A.3.1. Simulations of planet-disc interactions using Smoothed Particle Hydrodynamics

Original Abstract

We performed Smoothed Particle Hydrodynamics (SPH) simulations to study the time evolution of first one single and then two protoplanets embedded in a protoplanetary accretion disc. We investigated accretion and migration rates of a single protoplanet depending on several parameters of the protoplanetary disc, mainly viscosity and scale height. Additionally, we considered the influence of a second protoplanet in a long time simulation and examined the migration of the two planets in the disc, especially the growth of eccentricity and chaotic behaviour. One aim of this work was to establish the feasibil-

ity of SPH for such calculations, considering that usually only grid-based methods have been adopted. To resolve shocks and to prevent particle penetration, we introduced a new approach to artificial viscosity, which consists of an additional artificial bulk viscosity term in the SPH-representation of the Navier-Stokes equation. This allows for an accurate treatment of the physical kinematic viscosity to describe the shear, without the use of an artificial shear viscosity.

Structured Abstract

Aims. We studied the time evolution of first one single and then two protoplanets embedded in a protoplanetary accretion disc and established the feasibility of Smoothed Particle Hydrodynamics (SPH) for such calculations, considering that usually only grid-based methods have been adopted.

Methods. We performed SPH simulations to investigate accretion and migration rates of a single protoplanet depending on several parameters of the protoplanetary disc, mainly viscosity and scale height. Additionally, we considered the influence of a second protoplanet in a long time simulation and examined the migration of the two planets in the disc, especially the growth of eccentricity and chaotic behaviour. To resolve shocks and to prevent particle penetration, we introduced a new approach to artificial viscosity, which consists of an additional artificial bulk viscosity term in the SPH-representation of the Navier-Stokes equation. This allows for an accurate treatment of the physical kinematic viscosity to describe the shear, without the use of an artificial shear viscosity.

Results. [none in original abstract]

Comments

No results or conclusions are given in the original abstract.

A.4. Solar physics

A.4.1. Signature of oscillations in coronal bright points

Original Abstract

A detailed study is presented of two consecutive bright points observed simultaneously with the Coronal Diagnostic Spectrometer (CDS), the Extreme ultraviolet Imaging Telescope (EIT), and the Michelson Doppler Imager (MDI) onboard the Solar and Heliospheric Observatory (SOHO). Analysis of the evolution of the photospheric magnetic features and their coronal counterpart shows that there is a linear relationship between the EIT Fe XII 195 Å flux and the total magnetic flux of the photospheric bipolarity. This appearance of the coronal emission is associated with the emergence of new magnetic flux and its disappearance with the cancellation of one of the polarities. In one of the cases, the disappearance takes place ~3-4 hours before full cancellation of the weakest polarity.

The spectral data obtained with CDS showed that one of the bright points experienced short time variations in the flux on a time scale of 420-650 seconds, correlated in the transition region lines (O V 629 Å and O III 599 Å) and also in the He I 584.33 Å line. The coronal line (Mg IX 368 Å) undergoes changes as well, but on a longer scale. The wavelet analysis of the temporal series reveals that many of these events appear in a random fashion and sometimes after periods of quiet. However, we found two cases of an oscillatory behaviour. A sub-section of the O V temporal series of the second bright point showed a damped oscillation of five cycles peaking in the wavelet spectrum at 546 seconds, but in the last few cycles showed a lengthening of that period. The period compares well with the one detected in the S VI 933.4 Å oscillations seen in another bright point observed with the Solar Ultraviolet Measurements of Emitted Radiation (SUMER) spectrometer, which has a period of 491 seconds. The derived electron density in the transition region was 3×10^{10} cm^{-3} with some small variability, while the coronal electron density was 5×10^{8} cm^{-3}.

Structured Abstract

Aims. We present a detailed study of two consecutive [coronal] bright points.

Methods. We carried simultaneous observations with the Coronal Diagnostic Spectrometer (CDS), the Extreme ultraviolet Imaging Telescope (EIT), and the Michelson Doppler Imager (MDI) onboard the Solar and Heliospheric Observatory (SOHO).

Results. Analysis of the evolution of the photospheric magnetic features and their coronal counterpart shows that there is a linear relationship between the EIT Fe XII 195 Å flux and the total magnetic flux of the photospheric bipolarity. The appearance of the coronal emission is associated with the emergence of new magnetic flux and disappearance with the cancellation of one of the polarities. In one of the cases, the disappearance takes place ~3-4 hours before full cancellation of the weakest polarity.

The spectral data obtained with CDS show that one of the bright points experienced short time variations in the flux on a time scale of 420-650 seconds, correlated in the transition region lines (O V 629 Å and O III 599 Å) and also the He I 584.33 Å line. The coronal line (Mg IX 368 Å) undergoes changes as well, but on a longer scale. The wavelet analysis of the temporal series reveals that many of these events appear in a random fashion and sometimes after periods of quiet. However, we found two cases of an oscillatory behaviour. A sub-section of the O V temporal series of the second bright point showed a damped oscillation of five cycles peaking in the wavelet spectrum at 546 seconds, but in the last few cycles showed a lengthening of that period. The period compares well with the one detected in the S VI 933.4 Å oscillations seen in another bright point observed with the Solar Ultraviolet Measurements of Emitted Radiation (SUMER) spectrometer, which has a period of 491 seconds. The derived electron density in the transition region was 3×10^{10} cm^{-3} with some small variability, while the coronal electron density was 5×10^{8} cm^{-3}.

Comments

A well-organized and informative original abstract.

A.4.2. Three-dimensional numerical simulations of impulsively generated MHD waves in solar coronal loops

Original Abstract

Impulsively generated magnetohydrodynamic waves in a typical EUV solar coronal loop were studied numerically with the use of the three-dimensional (3D) FLASH code. Our results

revealed several 3D effects, such as distinctive time signatures collected at a detection point inside the loop. A slow magnetosonic wave generates a significant variation in the mass density profile with a time-scale on the order of 40s. A fast kink wave affects mass density, too, but its magnitude is much lower than in the case of a slow wave. Time-scales associated with the fast kink wave are generally lower than in the case of a slow wave, in the range of a dozen or so seconds. Temporal signatures of a fast sausage wave reveal ~ 5s oscillations in the quasi-periodic phase. Impulses which are launched outside the loop excite oscillations of a few seconds in the mass density. Time-signatures depend on the position of the detection point, and are usually more complex further out from the exciter.

Structured Abstract

Aims. We study impulsively generated magnetohydrodynamic waves in a typical EUV solar coronal loop.
Methods. We performed this numerical study by using the three-dimensional (3D) FLASH code.
Results. Our results reveal several 3D effects, such as distinctive time signatures collected at a detection point inside the loop. A slow magnetosonic wave generates a significant variation in the mass density profile with a time-scale on the order of 40s. A fast kink wave affects mass density, too, but its magnitude is much lower than in the case of a slow wave. Time-scales associated with the fast kink wave are generally lower than in the case of a slow wave, in the range of a dozen or so seconds. Temporal signatures of a fast sausage wave reveal ~ 5s oscillations in the quasi-periodic phase. Impulses which are launched outside the loop excite oscillations of a few seconds in the mass density. Time-signatures depend on the position of the detection point, and are usually more complex further out from the exciter.

Comments

A well-organized original abstract which could, however, benefit from some background information explaining the significance of the work within the context of current research.

A.5. Conclusions

Although it has no statistical significance, this study of randomly selected abstracts nevertheless demonstrates that a majority of the ten abstracts studied here would have benefitted from being structured. In some cases, the motivation and aims of the paper would have been much more apparent. In some other cases, the methods used in the investigation would have been explained more clearly, and in one case, the authors would have been led to describe their results.