

HOW TO USE AND TO PUBLISH WITH THE FREE AVAILABLE CODE Cesam2k

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Abstract. We present -1- a short description of the stellar structure and evolution code Cesam in its modern version – named Cesam2k – with its main options (physics and numerics) -2- the charter to publish results obtained with Cesam2k.

Keywords: stellar structure, stellar evolution, code

1 Introduction

For astrophysicists using Cesam in their research, we present in section 2, the genesis of this code and its present version – named Cesam2k – which is today the only version to use. In section 3, we summarize the main options (concerning physics or numerics) of this code. In section 4, we outline a user guide for standard or advanced users. Finally, in section 5, we present the charter of Cesam2k which explain the rules of publishing results obtained with Cesam2k.

2 A brief story of Cesam and Cesam2k

The story begins in 1987 with CESAM, an acronym for “Code d’Evolution Stellaire Adaptatif et Modulaire” (in English for an Adapative and Modular Code for Stellar structure and Evolution). This code was designed by Pierre Morel under encouragement of Evry Schatzman and Annie Baglin under the auspices of the GdR131. This first version was written in Fortran 77 and need to be compiled each time the user changes any options. With the help of Bernard Pichon, since 2001, a totally new version was designed and Cesam – renamed (of course) Cesam2k – rewritten in Fortran 90/95 with many important new features. Cesam2k was officially presented to the astrophysical community at Nice meeting in may 2003 (see <http://www.oca.eu/cesam/meeting.html>). Later on, a few colleagues contributed to some improvements : we can quote, for instance, the names of Yveline Lebreton, Sacha Brun, Laurent Piau (in chronological order). Note that Cesam (without 2k) refers to previous versions (cesam4 or cesam5, before 2001) now obsolete (no correction, no maintenance, ...) and not recommended to use.

3 A short description of Cesam2k

Cesam2k is (now) easy to use (see section 4) and is ready to use : it need only one compilation because all options are now included in the executable file. In its new version, Cesam2k remains free available **but**, to publish results obtained with it, need agreement with the authors. Hence, Cesam2k is a collaborative code always under development (see section 5 for details). The current stable version is (at mid-2010) V3.2.12 and the experimental one is V3.3.7. There is also a CoRot dedicated version (V1.1.8) created by Evelyne Lebreton at Meudon.

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Here, we present the main available options for the physics :

- Convection : 6 subroutines, plus the over- and the under- shoot and 2 convection criteria (Schwarzschild, Ledoux)
- Diffusion : microscopic, turbulent and, not yet public available, the radiative acceleration
- Rotation : the effects of rotation are treated with the help of the Maeder & Zahn's theory
- Equation of state : 8 subroutines with their associated data
- Opacities : 8 subroutines with their associated data (can be modified)
- Atmosphere : 5 subroutines, plus non-radiative Cayrel atmospheres (5 files of associated data), plus (not yet public available) Marcs atmospheres.
- Nuclear reaction network : 18 subroutines (the subroutine set also the chemical species followed during stellar evolution)
- mass loss : 4 subroutines
- Chemical composition : 7 premixed compositions; the user can modify abundance of any element

Here, we present the main 'user' available options :

- Stop criterion : 15 available
- Output format : 9 available
- Numerics : 13 predefined sets of numerical parameters (also, for very advanced user to modify any of these parameters in the so-called .rg files)

4 How to use Cesam2k

First, if you are interested to use Cesam2k, and as previously stated, the best choice is to contact one of the authors : <mailto:Bernard.Pichon@oca.eu> or <mailto:Pierre.Morel@oca.eu>. Note that, now, Pierre Morel is emeritus.

Only one configuration file need to be edited (the so-called .don files) and we recommend, for simplest models, to keep 'robust' physics. But, for 'advanced' physics, take care in the coherence of choices; some routines are not easy to use. Also, do not use experimental options without contacting one of the authors : as counterexample, Piau et al. (Astron. Astrophys. 506 (2009) 175) misuse an experimental version of Cesam2k (moreover not publically available (!)) which leads to erroneous conclusions about the effect of radiative accelerations and therefore a comment shall/should be published soon !!

For advanced users, few (sub-) configuration files are available, for instance, to modify the numerics, the chemical composition, the interactive plot, Experimental versions are only available upon request.

The new architecture of the code allows programmers to easily add new routines; the template of any physical subroutine is provided and the new routine is called through a generic call. Hence, Cesam2k is open to collective improvements and its use in the astrophysical community.

5 How to publish with Cesam2k

In brief, a charter is available (in French) since 2008 October 02 (http://www.oca.eu/cesam/charte_CESAM.txt) (see the text in annex).

The underlying idea is that the authors of any paper (which use Cesam2k in a significant manner) share the work with the principal authors of Cesam2k in adding their names as co-authors of the paper (as a "free remuneration" of all the previous work : many year-men). Note also, for the CNRS, the first indicator is the publishing rate !

Hence, Cesam2k is *de facto* a collaborative code.

In more details :

- For minor use of Cesam2k (in the sense of the main conclusions of your work would be achieved without it), the best is to inform us. We will answered with the appropriate acknowledgment to add in your paper and we also add your publication in the list of the publications that use Cesam2k.
- For important use of Cesam2k, the authors should contact us before publication. Note that, in this case, upon the basis of co-publishing, we can help you towards the best use of Cesam2k.
- The special case of contributors which improve (significantly) Cesam2k (for example, adding new physics such as rotation, diffusion, models of atmospheres, ...) : The authors must be contacted at least for advices (how to implement these new routines in the framework of Cesam2k). After that, depending on the work done, we guarantee, owing to the charter, that for each paper using these new routines, this new author benefits same returns as us. Remember always that Cesam2k is a collaborative code where authors are paid as co-authoring in your papers !!

For instance, we quote here a paper that violates the Cesam2k charter. Turck-Chieze et al. (Ap.J. 715 (2010) 1539) claims that they use a (new improved ???) version of Cesam2k **but** -1- This work is the comparison of Cesam2k with an another code, therefore this work use clearly Cesam2k with a very significant manner; -2- we are not aware of this (is it really true ? : no other previous paper describing the changes); -3- this paper clearly violates the Cesam2k charter (the Cesam2k web site is quoted in this paper); -4- Some sentences in this paper (for example, the quick description of Cesam2k) are wrong .

6 Conclusions

Our wish : Use Cesam2k with us !!

Improve Cesam2k with us and you will be welcome with us !!

7 Annex

L'utilisateur de Cesam2k (TM), quelle que soit la façon dont il s'est procuré la version qu'il utilise, s'engage *de facto* à suivre les règles suivantes. Afin d'éviter tout malentendu, les éditeurs des différentes revues scientifiques seront également alertés de l'existence de cette charte.

1) Il ne sera en aucun cas "propriétaire" de la version, même modifiée, chaque version du code étant donc publique. Seuls les auteurs primaires du code [PM, BP, YL] se réservent le droit de posséder et d'utiliser des versions "privées".

2) Par conséquent, avant toute publication scientifique, il en informera les auteurs primaires [actuellement] "Bernard.Pichon@oca.eu", "Yveline.Lebreton@univ-rennes1.fr" "Pierre.Morel@oca.eu" (chercheur émérite) en y indiquant clairement la part "dite essentielle" du travail relative à l'emploi de Cesam2k c'est-à-dire la part du travail sans lequel celui-ci n'aurait pas pu être fait s'il n'avait pas disposé de ce code. Cette information inclut obligatoirement l'envoi des sources nouvelles si besoin.

3) Les auteurs ainsi contactés lui signifieront, selon cette part essentielle du travail constaté (d'un commun accord) SOIT les noms des personnes qui devront figurer comme auteurs de la publication [cas le plus probable pour des articles dans des revues] SOIT les références et remerciements à inclure dans la publication [cas le plus probable pour des communications à des congrès, colloques]. Il va de soi que vu le type de partage "collaboratif" (au seul "cout gratuit" de la présence dans la liste des auteurs de 2 ou 3 noms supplémentaires) de ce code, chaque utilisateur "régulier" aura le profit de toutes corrections d'erreur signalées et de toutes les améliorations publiques.