

# Astronomy and Astrophysics

Astronomy and Astrophysics, a Europhysics journal, has attained fame among astronomers and astrophysicists. It is, altogether, very strange that it has not yet attained the same fame among physicists as the well known American Astrophysical Journal. This paper is meant to arouse the interest for Astronomy and Astrophysics among physicists, not only for the purely astrophysical papers, but also for those papers with a genuine physical subject, which have been written for the purpose of solving a well defined astrophysical problem.

Astronomy and Astrophysics was founded in 1969 from the merging of several famous journals: *Zeitschrift f. Astrophysik*, founded by A. Unsöld in the early twenties; the old and respectable *Bulletin Astronomique*, where a number of major papers in celestial mechanics and fundamental astronomy have been published; the more recent *Annales d'Astrophysique* founded in 1938 and the older *Journal des Observateurs* where much data of various kinds have been published; *Arkiv f. Astronomi*, the well known Swedish journal, and last but not least the BAN (Bulletin of the Netherlands Astronomical Institute, where some of the corner stones of modern astrophysics have been placed.

All European countries, except the United Kingdom, take part in the editing; the British astronomers, organised in the Royal Astronomical Society, decided to continue the publishing of their Monthly Notices. The merging had become necessary for a reason which resulted from an analysis of the index of quotation: the papers published in the Astrophysical Journal were quoted twice as often as those published in all European astronomical journals together. This was undoubtedly due to the dispersion of the papers in half a dozen journals, which made any reference work lengthy and difficult. The merging of these journals was the proof of the good will of European minded astronomers, and it turned out to be successful, at least as far as the fame of the journal is concerned.

It may be difficult to analyse almost six years of publications and a total of over 15000 pages. In the following, I shall avoid quoting precisely any paper, otherwise I would simply have to write a long illegible list of titles.

Physicists of almost any field are concerned by the subjects which have been dealt with in Astronomy and As-

trophysics, from hydrodynamics to particle physics, and I shall review here what I think are the highlights of the journal.

(i) *Hydrodynamics*. Linear and non-linear hydrodynamics have been approached. One of the major questions, the stability of systems, has been studied in several papers. The fact that the systems which have been studied are stars does not decrease the importance of the results which have been obtained, especially in distinguishing local from global instability. The old problem of the Benard cells has received a new approach in the case of the stellar corrective zones. Magnetic hydrodynamics has received special attention and a number of papers have been concerned with wave propagation. The case of propagation in a random medium with the theory of energy exchange between different modes, proved to be a very fruitful subject, the methods which have been devised being applicable to all transport problems in random media.

(ii) *Condensed state*. The solid state is present in white dwarfs and neutron stars, in planets and interstellar dust. The case of the Coulomb crystal has had interesting developments, with the study of phase transitions and latent heat of melting.

(iii) *Gas dynamics*. A large variety of problems concerning gases have been considered: plasma dynamics, relativistic plasmas (including the gravitational plasma), interaction of radiation with a plasma out of thermodynamic equilibrium, optical test of a plasma out of thermodynamic equilibrium, transport problems including a variety of thermodynamic cases, as for example electric conductivity in the presence of radiation pressure.

(iv) *Atomic Physics*. Two classes of subjects are classical problems for astrophysicists: transition probabilities and theory of collisions. The first one is related to the strength of spectral lines and the quantitative analysis of spectra. The second one is related to the study of gases out of thermodynamic equilibrium and the broadening of spectral lines. Many important papers on this subject which is probably the best representative of Physics in Astrophysics have been published in Astronomy and Astrophysics. Specially noted should be several reference papers on collision broadening and Lindholm shifts.

(v) *Molecular Physics*. The recent developments in infra-red astronomy

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and the discovery of interstellar molecules, has led to new studies of molecules. Oscillator strengths for a variety of molecules observed in stars, some of them with very exotic composition, have been determined. New estimates of the effect of collisions have also been given. This new field is very promising and will certainly lead to important discoveries.

(vi) *Nuclear Physics*. A number of papers are concerned with nuclear physics. It has been necessary in many cases to devise relevant extrapolations to deal with astrophysical problems, such as the propagation of cosmic rays in the galaxy. High temperature nucleosynthesis has also been considered.

(vii) *Particle Physics*. The problem of matter and anti-matter has been especially considered. Not only high temperature thermodynamics has been studied, but also the problem of annihilation in a gas in thermodynamic equilibrium, through all kinds of collisions, including the  $\text{H}\bar{\text{H}}$  collision and the radiative capture of  $\text{pp}$ .

(viii) *Methods and Instruments*. The discussion of new physical processes results from the use of new and powerful means of exploring the universe: new spectral range, higher resolving power in wavelength, better analysis of the signal including a higher resolution in angle and in time.

Of special interest are the papers on very long base interferometry, on the infra-red instrumentation, on the treatment of the signal and the contraction of the information (with use, for the happy few, of the Karunen-Loeve functions).

It is even more difficult to conclude such a review than to introduce it. To progress in our understanding of the Universe it is necessary to use better tools and more elaborate physical theories. Physicists are beginning to approach astrophysical problems as much as astrophysicists are lead to deal with more sophisticated physical problems.

It might be difficult for a physicist to decide from astrophysical observations what kind of physical problems are relevant to astrophysics. The reading of the physical papers published in Astronomy and Astrophysics can lead him to think further, and perhaps give the solution which the astrophysicists badly need. It can happen that the physicists will find in the physical papers some new and interesting subject to think about.