TO THE FOUNDER OF THE JOURNAL ASTROFIZIKA, ACADEMICIAN

V. A. AMBARTSUMYAN

Dear Viktor Amazaspovich,

The editorial board and editorial council of the journal Astrofizika sincerely congratulate you, one of the greatest astrophysicists of the day, on your 80th birthday.

In your person we greet an eminent scientist and organizer of science. We are particularly pleased to note that besides numerous and important duties you guided the work of our journal, which was founded through your efforts, for many years.

Your services are highly regarded, both in our country and abroad. It is sufficient to mention that you were twice awarded the title of Hero of Socialist Labor. You have been elected as an honorary or foreign member of the academy of sciences of more than 25 countries, and you are an honorary doctor of many well-known universities. The scientific community of the world has fittingly recognized your activity by electing you a vice president and then president of the International Astronomical Union and president of the International Council of Scientific Unions.

We wish you good health, well-being, and new successes in your many-sided activity for the good of our people.

Editorial Board and Editorial Council
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TO VICTOR AMBARTSUMIAN ON HIS 80TH BIRTHDAY

S. Chandrasekhar

It is a privilege to join Academician Victor Ambartsumian's many friends and colleagues all over the world in congratulating him on his eightieth birthday and to express gratitude for a lifetime of efforts towards scientific ends. The only other astronomer of this century who compares with Academician Ambartsumian in his constancy and devotion to astronomy is Professor Jan Oort; but they would appear to be dissimilar in every other way. It will be a worthy theme for a historian of science of the twenty-first century to compare and contrast these two great men of science.

Academician Ambartsumian's realm does not divide astronomy and astrophysics into its conventional parts: theoretical and observational. He is an astronomer par excellence.

As one whose main interests during the past thirty or more years have been outside the mainstream of astronomy, the task of writing an essay encompassing all of Ambartsumian's wide range of accomplishments is outside the circumference of my comprehension. And since many others more conversant than I will be writing about him for this issue, perhaps I may recall some of Ambartsumian's discoveries which reveal the elegance and clarity of his ideas.

1. One of Ambartsumian's earliest papers was concerned with Zanstra's method of determining the temperature of the central star illuminating a planetary nebula. Here is Ambartsumian's formulation which led to a first treatment of the radiative equilibrium of a planetary nebula:

There is a probability, p, that an ultraviolet light quantum (that is a quantum beyond the head of the Lyman series) will be transformed into a Lyman-alpha quantum by the process of ionization and recombination followed by cascades: a simple statement that succinctly epitomizes Zanstra'a idea.

2. The "blanketing" effect of absorption lines, in warming a stellar atmosphere, can be formulated in a first approximation by postulating that in a given frequency interval there is a probability, p, that an absorption line will occur. With such a formulation, the equations of radiative transfer governing thermodynamic equilibrium can be readily written down; and one obtains a satisfactory theory for the underlying phenomenon.

3. The formulation of the principles of invariance in the theory of radiative transfer: a theoretical innovation that is of the greatest significance. Many papers were contributed to a symposium on this topic at Byurakan in the fall of 1982; and in my contribution to that symposium I narrated the influence of Academician Ambartsumian's ideas on my own related work.

4. Ambartsumian's marvelously elegant formulation of the fluctuations in brightness in the Milky Way: in the limit of infinite optical depth, the probability distribution of the fluctuations in the brightness of the Milky Way is invariant to the location of of the observer. In the related series of investigations, in part in association with Academician Markarian, Ambartsumian introduced for the first time the now commonly accepted notion that interstellar matter occurs in the form of clouds.

5. Ambartsumian's discovery of the role of the escape of stars from galactic clusters resulting from the relatively short times of relaxation is as simple as it is profound.

6. Ambartsumian's recognition of stellar association as a dynamical entity with far-reaching implications for subsequent theories relating to star formation. I recall the scepticism with which his ideas were received when I first gave an account of

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Ambartsumian's ideas at a colloquium at the Yerkes Observatory late in 1946.

It was about this time that my own interests began to diverge from astronomy. But I am aware of Ambartsumian's founding of the Byurakan Observatory in Armenia, of the extremely important work that continues to be carried out at the Observatory, including of course Markarian's brilliant work on the discovery and cataloging of galaxies known by his name; and of the discovery and of the prevalence of flare stars.

There can be no more than two or three astronomers in this century who can look back on a life so worthily devoted to the progress of astronomy. It is a privilege to have known him and to wish him the very best on his reaching his eightieth birthday.

VICTOR AMBARTSUMIAN AND THE IAU

Jean-Claude Pecker

Few astronomers have had such a deep influence as Victor Ambartsumian has had on the life of the international bodies devoted to the promotion and defense of astronomy and science in general. I remember that, years ago someone asked me whether I was spending more time in astrophysical research or in teaching. I told him that the divisions of astronomical activity were not the ones he implied: there is astrometry on one side and astrophysics on the other side, but astropolitics is possibly, for some of us, the most important part of all. Professor Ambartsumian has been exemplary, in the sense that, a very active and productive astrophysicist himself, he entered into astropolitics without doing any harm to his scientific output.

President of the International Astronomical Union from 1961 to 1964, past-president and councilor of the Executive Committee from 1964 to 1967 then he became President-elect of the ICSU, and president of ICSU from 1970 to 1974: a record difficult to achieve and possibly unpaired amongst astronomers!

I had met Professor Ambartsumian much earlier indeed. He was amongst the few Soviet astronomers who visited France immediately after the Second World War and he came to our country on several occasions since. But, of course, the IAU was an ideal place to meet. First it took place in Rome, in 1952, at the General Assembly of the IAU. At that time, I witnessed the brilliant intuitions of Ambartsumian. It was the far-reaching discovery of O and T associations, the recognition of the importance in stellar births of explosive events, the studies of active galaxies... and in a quite different field, the celebrated invariance methods applied to solve difficult transfer problems. And, in 1958, in Moscow, as a guest to the Tenth General Assembly, Professor Ambartsumian expressed his ideas in the most enthusiastic way, as such:

"En faisant la part qui leur est due aux perfectionnements des moyens d'observations, je voudrais toutefois souligner l'importance décisive des recherches théoriques. Pendant les années qui se sont écoulées aprés l'Assemblée de Dublin, la théorie a compté de grands succés à son actif. Cependant, nous vivons à une époque où l'on peut imposer à la théorie de plus hautes exigences.

Je suis profondément convaincu que nous touchons à une étape du développement de l'astrophysique qui nous ouvre de nouvelles propriétés de la matière, qui ne pouvaient étre mises à jour dans les conditions qui existent dans les laboratoires terrestres. En d'autres termes, je voudrais dire que de nombreux phénoménes et lois de la physique stellaire que nous avons établies par voie empirique, à l'aide d'observations astronomiques, ne pourront étre expliques que par suite d'un approfondissement des conceptions de la physique théorique moderne.

Parmi les phénomènes qui exigent des efforts particulièrement grands des théoriciens et qui sont des problèmes de base de l'astronomie moderne, il faut citer, par exemple: 1) Le problème des étoiles non-stables. 2) Le problème des explosions des supernovae. 3) Le problème de l'origine des jeunes groupes stellaires. 4) Le problème de la formation

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des bras spiraux des galaxies. 5) La question de la nature des radiogalaxies. 6) Le phénomène d'éloignement reciproque des galaxies lointaines. 7) La question de la nature de la matière intergalactique. 8) La question de l'origine des rayons cosmiques. 9) Le problème de l'origine des éléments.

Le fait que malgré l'accumulation d'une énorme quantité de donneés d'observations et l'établissement de toute une série de lois empiriques, qui décrivent ces phénomènes, nous sommes encore trés éloignés de leur explication théorique, indique que les théoriciens dans leur travail commun avec les observateurs, doivent multiplier leurs efforts".

When in 1961, we were both elected to the Executive Committee of the IAU, we thus knew each other already quite well. I was Assistant General Secretary, he was President. The General Secretary was Donald H. Sadler, a remarkably efficient man, with a perfect knowledge of the IAU, with a precise and subtle mind, an excellent General Secretary indeed, and an excellent friend. From him, I got clear instructions on what I had to do about the organization of symposiums, and other tasks for...beginners. It was a perfect training for the years which were to come. From Sadler's behavior, Professor Ambartsumian got the feeling that everything was going smoothly in the IAU. Hence he decided not to play an exaggerated role and to leave more or less a free hand to Sadler; and this was indeed quite wise. Only the letters of political importance were sent to him, whenever his advice was really needed he responded with simplicity, kindness, and very much to the point. His comments were invaluable and fortunately rare: which meant that the health of the IAU was very satisfactory.

Occasions occurred when the personal qualities of Professor Ambartsumian could be more readily appreciated. Every year, the Executive Committee met, as it is still the case. In 1962, we were fortunate enough to meet in Yerevan. This was my first trip to Soviet Armenia, and I keep the best memories of it. We had then the opportunity to meet the young Armenian astronomers, a group of first class scientists, gathered around the strong personality of Professor Ambartsumian amongst a set of good instruments, in a beautiful spot of the Armenian hills, in front of the two summits of Ararat, above the valley of the river Kasakh, in Byurakan. I remember meeting then Markarian, Mirzoyan, Khachikian, and many others. But it was also an occasion to renew acquaintance with some of my old friends, Hagihara, Sternberk, Stoy, or Fricke, Goldberg, Haro, Oort, and also Dorothy Bell, then our Miss IAU, and of course Sadler, and Ambartsumian himself. The meetings of the Executive committee, I am not sure whether I remember them in detail. The tandem Sadler—A,bartsumian was, I know, very efficient in expediting the affairs of the Union. So our work was soon finished and we could then visit the country. What a country! Under the very hot sun, we went everywhere... Byurakan of course, telescopes, radiotelescopes, the red stones in the garden's shadows, and the flowers. But also, for example, a memorable trip to the Lake Sevan. We went up there in the morning, with the idea of coming back to Yerevan for lunch, and visiting some exhibit. But the sun was very hot; and the lake, so quiet in its blue shades, and the dry horizons under the blue sky, and the silence, and the peace of a landscape that could well have been just the same many centuries ago... . Well, we did not come back. Oort, the first, was daring enough to dive into the lake; soon after him, a theory of dignified astronomers had chosen the freedom of swimming and enjoyed leisurely their sunny day. Ambartsumian was of course worried: what about the schedule? Soon it was obvious that we could not do it. So Ambartsumian, with his realistic mind and his creative imagination, took the initiative. We dried ourselves, and when ready to eat (the bathe made us quite hungry!), we found, in a little field above the lake, a basket full of country bread, and another one full of those tasty grapes with small dark grains, and finally, beautiful trout just fished from the lake, these huge salmon trouts, with a dotty skin, and a pink flesh, in the way of being grilled on an improvised wooden fire. Of course, no forks, no knives. But who needed forks and knives, centuries ago, on the shores of Lake Sevan? We managed well... and we came back quite late to Yerevan, much after all exhibits were closed.

The following year, 1963, it was Liège. The strawberries in Pol Swings' garden, and the friends, and the warmth, and the wise decisions of our master tandem. One cannot evoke the days of Executive Committee meeting without a very rare feeling of having been a member of a fine group of distinguished people, but also of having shared the international efforts towards mutual understanding, towards common achievements, towards some of the necessary ingredients of necessary peace. The IAU, in this respect, is exemplary;

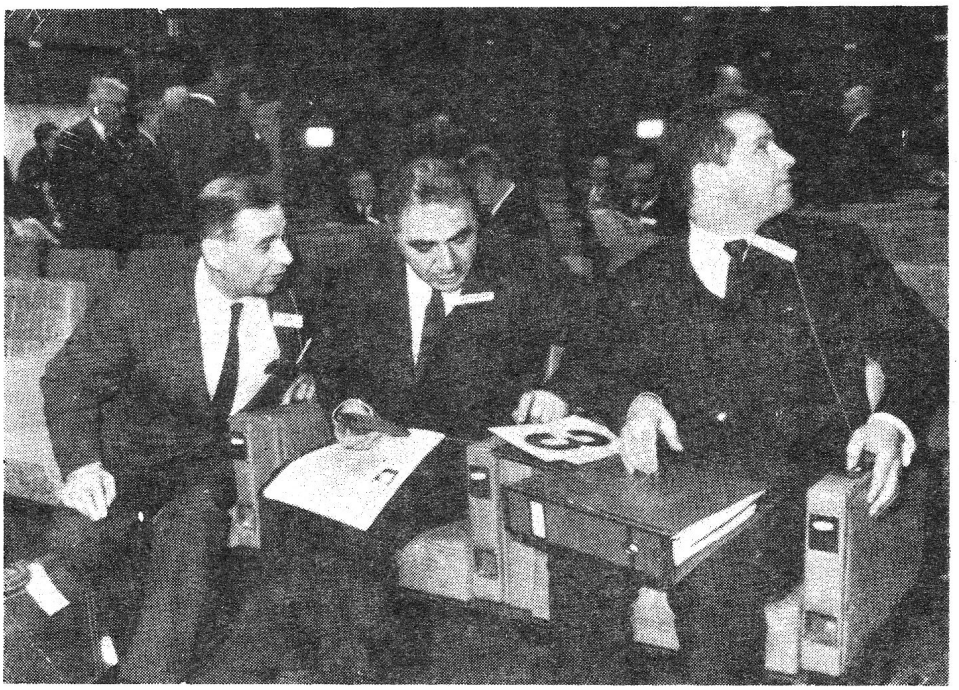

Fig. 1. D. H. Sadler, V. A. Ambartsumian and J.-C. Pecker during the ICSU meeting in Vienna (1963).

one can see in the Executive Committee, and very friendly indeed, scientists from USSR and South Africa, from USA and Australia, from France and Japan... . And they represent a still broader family, as IAU has individual members, in contradistinction to the other scientific Unions. Not only do they meet every third year within a General Assembly, but they do daily work together. More than any other science, astronomy needs coordination, continuity in observing solar phenomena or active stars, completion in surveying, with comparable methods and instruments, the skies from the South and those from the North.

Sadler, Ambartsumian, and myself had then, in addition, a somewhat broader contact with the scientific community, through ICSU. At Vienna, for example, in 1961, where long discussions concerned the adherence of some new Unions, where the problems of free circulation of scientists appeared as an important one, where also many interunion activities were decided. As representative of USSR Ambartsumian had later a renewed contact with ICSU, and became its President; unfortunately I was not then anymore the IAU representative; hence I missed the pleasure of working again with Professor Ambartsumian. But there again, as in the IAU E.C., I know that his firm authority and his sense for the human as well as his humor, did wonders.

Our friendly relations could not of course cease at that point. I was fortunate enough to spend three months in Byurakan, in 1973, and I remember the exciting discussions in front of a blackboard, concerning the basic sequence of classical galaxies to the most extreme quasars, concerning also the more classical problems of the structure of ionized hydrogen and helium circumstellar regions.

I celebrated then my fiftieth birthday, in May 1973, at the Observatory in Byurakan: I was presented with a fine copper image of the lady of Lake Sevan, Achtamar, and it was the usual unforgettable banquet.

Later I met Ambartsumian at several occasions. The last one, a few years ago, left me with a very strange feeling. Professor Ambartsumian was a member of a delegation of seven representatives of the Supreme Soviet. They were visiting France at the invitation of the Foreign Affairs Commission of our National Assembly. Quite naturally, Ambartsumian had asked to be received by some scientists of an equivalent rank. It was difficult indeed, as no one in France is both member of the Academy of Sciences and of the National Assembly. Professor Jean Bernard, one of the most distinguished hematologists in the world, was then President of the National Academy of Sciences, of which Ambartsumian had been elected some years before as a Foreign Member. Jean Bernard, who

happened to have a very heavy schedule, asked me to receive Professor Ambartsumian in the name of the Academy, and gave me clear instructions. As I did not want politics to intervene with my relations with Ambartsumian, I decided that we would first have a nice dinner (fish of course, in memory of Lake Sevan), just between the two of us, and speaking only of astronomy and Armenia. And the day after, we met officially, at the Academy, around a cup of tea (of which I believe he was not more fond of than I was myself), together with interpreters, and officials. Whenever we generally didn't speak English together, Professor Ambartsumian spoke Russian, and I spoke French. In essence, we agreed. He first delivered a message on behalf of the Soviet Academy of Sciences: more cooperation in science between our two countries is needed and wanted. I could not but fully agree with him. Had I not prepared, some years before, the space bilateral agreements, in Moscow? However, I had now to stress the fact that this cooperation was not at present unanimously wanted; and that it could be effective only at the expense of more freedom to the circulation of scientists, between the two countries, in the spirit of ICSU recommendations.

I can only express here the hope that the conditions might soon become such as allowing indeed a better cooperation between the scientists of the two countries, and in particular a cooperation involving our colleagues of the Armenian Soviet Republic.

I have elsewhere ("Problems of Physics and Evolution of the Universe") expressed my admiration for the scientific imagination and rigor of Professor Ambartsumian. Let this paper be witness to the admiration I have for him when dealing with many problems of astropolitics. We are of course not always sharing the same points of view, and I just gave an example of these disagreements. But can we expect from all protagonists in a debate to agree with each other in every respect? It would not be anymore a debate; and it would look very artificial indeed. At least, the debate may soon transform opponents into friends. They do not necessarily agree with each other; but they respect each other.

The old days of our common work within IAU have built up a very solid friendship indeed, and a mutual respect. The wise, quite humorous attitude of Professor Ambartsumian cannot be forgotten; he had a very strong influence on world astropolitics. All the astronomers of my generation remember this period with a sort of nostalgia and also with pleasure — including Lake Sevan. Some of the most happy days of my life as an astronomer are certainly associated with my work under Victor Hamazaspi Ambartsumian as President of the IAU.

ENCOUNTERS WITH VICTOR AMBARTSUMIAN ONE AFTERNOON AT THE SAN LAZZARO DEGLI ARMENI ISLAND AT VENICE

Leonida Rosino

I do not recall when I had the occasion to meet Professor Ambartsumian for the first time. His name was already known to me as one of the greatest astrophysicists as early as in 1939 at the beginning of my career as an astronomer. I believe however that I was introduced to Professor Ambartsumian a few years after the end of the war, at one of the General Assemblies of the IAU, either at Zurich in 1948 or at Rome in 1952. Later the occasions for our encounters increased, both in Padua and in Yerevan, Armenia.

I remember in 1966 at a meeting on "Active Galaxies" organized by the Byurakan Observatory, I had the opportunity during an excursion to Lake Sevan to discuss with him our common research programs. I was occupied then with the variable stars of the Orion Nebula and, in particular, the "flare stars" that are found in great numbers there. I was extending the search of such stars to the Pleiades, Hyades, and other open clusters. This work followed the research initiated at Tonantzintla by Guillermo Haro and at Byurakan under the leadership of Professor Ambartsumian. We had the occasion to speak of these enigmatic stars with a view towards future collaboration in this area.

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Other ocassions for mutual encounters were not lacking in the following years. I want to dwell for a moment on the visit that Professor Ambartsumian made to Padua in 1969, where we had invited him to give a seminar in the course of one of his visits to Italy. He had expressed the wish to visit Venice, the Island of San Lazzaro Degli Armeni, a charming place in the Lagoon, where the convent of the Padri Armeni Mechitaristi is located. It was found two and a half centuries ago by the Armenian Pietro de Mansig (called Mechitar) with the purpose of assisting the Armenians, numerous at that time in Venice, who had fallen in distress from poverty and illness. After some time the convent became quite prosperous and today it is conducted by the Armenian priests called "Mechitarists." It is one of the most important Centers of Armenian art, culture and education; a real pearl of the Orient in Lagoon.

It was Saturday and on the next day, after a telephone call to the Island to announce the visit, we went from Padua to Venice and from there, in the afternoon, to the Lido. A gondola was waiting there to take us to the Island. As we were approaching San Lazzaro Island we were surprised to see a crowd of people on the walls surrounding the island. They appeared to be cheering towards us. The crowd was composed of Armenian friars, seminarists and students, living in the convent. The fame of Professor Ambartsumian and his work on behalf of his countrymen, as the President of the Armenian Academy of Sciences, was well known to the Mechitarist Fathers. The announcement of his visit was therefore received with the greatest pleasure and Professor Ambartsumian was welcomed as a most distinguished guest by the Rector and the entire Armenian Community. There was a solemn reception in the Central Hall with an exchange of complimentary speeches (in the Armenian language). A parchment was offered to Professor Ambartsumian in memory of his visit. Under the guidance of the Fathers we were then conducted on a tour of the treasures of the Island: the wonderful gardens and the ancient Convent. Especially impressive was the Library, so rich in Armenian books, of incunabula and of more than two thousand Armenian manuscripts decorated with beautiful miniatures, real masterpieces of the 9—11th centuries. We also saw many other documents concerning the History of Ancient Armenia.

I well remember that Professor Ambartsumian was much moved by the demonstration of esteem and affection offered by his countrymen, living in this remote outpost of Armenia Culture. The people were far from their own country, mostly in consequence of the dreadful Turkish persecutions of 1915 and the "Diaspora" which followed. The Armenians are always and everywhere united by the common love for their ancient country, far above any political or religious differences. The visit of Professor Ambartsumian was absolutely unexpected and yet all appeared as if it were awaited for a long time.

The hours were passing rapidly and finally in the late afternoon we were taken by a motorboat from San Lazzaro to Venice to visit the Armenian College of the Mechitarist Fathers in Palazzo Zenobio at Carmini. The College is frequented by young Armenian students coming from every part of the world to complete their classical studies and learn the language and the history of Armenia. There was again great excitement concerning the visit of Professor Ambartsumian and a reception by the Director of the College was held in his honor. And there was also another surprise: in one of the beautiful rooms of the Palazzo we saw a portrait of Professor Ambartsumian hanging on one of the walls close to that of the great Armenian composer Aram Khachaturian.

It was an unforgettable day and we returned to Padua late in the evening.

Since that time occasions for meeting Professor Ambartsumian were relatively frequent. In 1967 he was elected Foreign Member of the Academy of Lincei, the most prestigious Academy of Sciences and Letters in Italy. I met him in Samos on the occasion of of the celebration of the 23rd century since the birth of Aristarchus. He invited me to visit the Byurakan Observatory and so I had the opportunity of seeing some of the most picturesque localities in Armenia and, at the same time, getting better acquainted with research carried out at the Byurakan Observatory. This was an occasion to create, under the auspices of the Academy of Sciences of the Soviet Union and the Academy of Lincei, a convention for a common program of research and exchange of astronomers between the Observatory of Asiago and that of Byurakan. This coordination has been very fruitful.

What else shall I say. I will recall here the important studies made by Professor Ambartsumian and his collaborators, under his strong impulse, on "flare stars" in nebulae,

associations and open clusters, those on the "fuors," the enigmatic variables of the FU Orionis-type and on the nebular variables. He has not only proposed original interpretations of the phenomena occurring in these young stars, but has solved with an ingenious statistical treatment the problem of revealing, with yet uncomplete data of observation, the total number of flare stars probably present in a given cluster. This is really a marginal aspect of the researches of Professor Ambartsumian. Other colleagues will certainly relate in this issue his fundamental contributions in all of fields of physical and mathematical astronomy, from binary stars to planetary nebulae, from stellar statistics to celestial mechanics, from theoretical astrophysics to cosmology.

In conclusion, I am happy to convey, in the name of my Italian colleagues, their best wishes to Professor Ambartsumian on the occasion of his 80th birthday for a long, happy and active life. Besides his high scientific merits I shall always remember his human qualities, his amiability, kindness and goodness towards all his collegaues and disciples.

AN OBSERVATIONAL APPROACH TO STELLAR EVOLUTION

Guillermo Haro (deceased)

As a natural consequence of the 17th century Newton's physical ideas, some fundamental assumptions emerge regarding the formation of stars out of interstellar dense clouds. Helmholtz and Kelvin postulated more than a century ago the formation of stellar objects through a gravitational contraction mechanism. Of course and as far as I know, the Angloamerican astrophysical H. N. Russell was the first to describe qualitatively the early stages of star formation. He wrote in 1913: "Such [a contracting star], when it began to shine, would be red of low surface brightness, but of very low density and great surface, so that its total line emission would be large. As it contracted it would grow smaller, hotter, whiter and increased in surface brightness so that its light-emission would not change much." Then he described the initial stage of a star as a sphere of very rarefied gas and larger diameter, with central temperature of a few thousand degrees contracting very rapidly, drawing upon its gravitational energy. A star of great initial mass, according to Russell, would evolve crossing the [M_{bol} vs. spectral class] diagram near its top and joining the main sequence at class O, B or A. The ones with smaller masses might arrive at F, G, K or M types.

The present theoretical investigations of the contraction process follow, at a more or less sophisticated way, Russell's main ideas. I do not intend to follow the modern arguments of the supposed contraction formation process; but I just want to indicate that, to my knowledge, there are not convincing tests for this kind of a theoretical approach to star formation. Probably it will be of interest to quote again a paragraph written by Sir Arthur Stanley Eddington (in Background to Modern Science pp. 128 and 142, Cambridge University Press, 1938): "... To return to historical order... the next big sensation in stellar astronomy was the Giant and Dwarf Theory put forward by Hertzsprung and Russell, which came into prominence about 1913. In 1900 we were supposed to understand thoroughly the course of stellar evolution... But whereas in most branches our knowledge has greatly advanced, our knowledge of stellar evolution seems to have diminished, until now it is represented approximately by the symbol 0... ."

For many years and in relation to the photometric studies of very young clusters, great emphasis was given to the stars lying above the normal (V vs. B—V) main sequence. This was and perhaps still is considered as a very strong observational support of the gravitational contraction theory for the formation of stars. The color-magnitude diagrams of Walker and Johnson published for the NGC 2264 and Orion aggregates clearly show that starting at a given point in the disgrams of these two stellar aggregates the star members — mainly T. Tauri and T-Tauri like objects — lie high above the main sequence up to the visual magnitude approximately 15.

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However, there is no doubt that the Johnson-Walker results were seriously affected by observational selection in the sense that the faint cluster members were not included.

From the very beginning of my search in Orion and NGC 2264 I noticed the existence of T-Tauri stars with abnormally strong blue and ultraviolet colors, and that introduced my first doubts about the Walker and Johnson results. Of course, before my findings there were indications that at least in some T-Tauri stars the strength of the continuous emission increases towards shorter wavelengths when the normal energy distribution of the underlying stellar spectrum is used as reference. Later on, during my stay at the Mt. Palomar Observatory as a visiting research fellow, I had the opportunity of obtaining several 48" Schmidt camera plates in which I made two or three different exposures in two or three different colors either in the V and U bands or in the three UBV bands, reaching stars of the 19.5 visual magnitude. On these particular plates I confirmed my preliminary results, finding a large number of T-Tauri like stars, many of them with H_α emission in the Tonantzintla spectral plates. In general, it seems that the occurrence of an ultraviolet excess in the H_α emission stars is better correlated with the presence of strong emission lines in the photographic region with the strength of the bright H and K lines of Ca II. Up to the faintest limit of the Palomar multiple exposure plates there is an increasing number of ultraviolet T-Tauri stars. A very striking example of these faint ultraviolet stars in the Orion Nebula, among others, is the Brun star No. 276 from which Walker derives visual magnitude = 18.04 and and $U-B = -0.99$. We classify this particular object as of early spectral K type and even after correction for interstellar absorption it lies about 2.5 magnitudes below the normal main sequence.

It seems very plausible that there exists among the T-Tauri objects a "natural" sequence in which we can order the stars according to the relative strength of their ultraviolet excesses: from the very strong and more or less steady ultraviolet cases passing through the ones in which the ultraviolet emission undergoes frequent or perhaps continual changes up to the stars such as the great majority of the flare objects in which the ultraviolet emission appears only during the occasional outburst.

With the risk of being repetitive, I want to state that observationally it seems quite well established that the T-Tauri stars as well as some other stellar or semi-stellar objects considered as very young are always found associated with dark and bright nebulae and this fact, among other arguments, has apparently led to two fundamental contradictory suppositions.

First, the "nebular" star must represent an early stage of nebular contraction process by which the stars in general are supposed to have been formed.

For several reasons I avoided this conclusion. I dare to say that among my reasons for this there is an epistemological one, which I will try to support, at least partially, on the basis of some observations and considerations.

Second, the T-Tauri stars and many of the stellar objects embedded in nebular material must be extremely young and the observations of their peculiarities point to the reasonable fact that they do not exist in stellar groups or aggregates older than few times 10^6 years and consequently we do not find them in clusters or associations older than very few times 10^7 years. A very beautiful example of the latter can be represented by the Pleiades group. In this second hypothesis the stars are not formed by gravitational contraction but by a process of fragmentation or explosion of very dense stellar or pre-stellar nuclei. The main leader of this second heterodox supposition is Academician Victor Ambartsumian.

As I said before, there are no sound observational tests for the gravitational contraction star formation process although the great majority of astronomers postulate it. Paradoxically enough most of the astrophysicists who maintain this gravitational contraction theory support and believe in the highly mythological supposition that the whole Unverse started through the Big Bang Bomb of a primitive superdense "atom" suggested by the Belgium priest and scientist George Lemaître.

Apparently at the very beginning the Lemaître primitive atom has a quasisymmetrical structure and composition. The matter being slightly greater than the antimatter, a few microseconds after the supposed explosion the temperature went lower and the

antimatter was annihilated, so in this way the expanding Universe and our present metagalaxy are composed only of common matter. This particular conception is analyzed by Professor Hannes Alfvén and wittily criticized.

How can we explain, Alfvén said, the tremendous cosmic explosion in the nuclei of galaxies which merely due to Ambartsumian's studies are supposed to be by large greater than the most spectacular explosion of a supernovae. With the discovery of the quasistellar objects (QSO) Alfvén says a still more gigantic release of energy was found. Does this represent the upper limit? Obviously not, Alfvén states. In this latter case a release of nuclear energy is not sufficient as it is possibly behind the case of supernovae. According to Alfvén and others the only reasonable energy source for this supergiant explosion in galaxies seems to be matter—antimatter annihilation, although this point of view implies a rather drastic revision of present physical theories.

Going back to the problem of the formation of stars, although the present orthodox physics cannot explain the dense pre-stellar matter postulated by Ambartsumian as the original starting point of star evolution, which we in fact observe everywhere is explosions, ejection of matter, steady mass loss as in the extraordinary case of the SS 433 star system (VI 343 Aql) with twin Doppler shift with a range of 80 000 km/sec which has been observed. Perhaps we can add cold outflows and enigmatic jets around young stellar objects.

According to Charles Lada it is now generally accepted that during the earliest stages of evolution most, if not all stars, undergo a phase of very energetic mass ejection frequently characterized by the occurrence of massive bipolar outflows of cold molecular gas. A notable manifestation included the rapid moving of the so-called Herbig—Haro objects, high velocity maser sources, shock-excited molecular hydrogen emission regions and optical visible jets with fantastic quasirelativistic velocities. However, Lada said, despite the vast body of intriguing and valuable observational data that has been accumulated in an intense effort during the last few years, our understanding of the outflow phenomena is still in its infancy.

It would be very long just to enumerate all the very striking known observational cases of well-established nebular matter ejection or explosions, starting let us say with the nova, cometary and planetary nebulae cases, passing through the supernova remnants up to the colossal explosions in the QSO. In our galactic vicinity we observe practically always explosions and expansions and not one single case of apparent and not doubtful contraction. From the very massive OB associations, the P-Cygni type stars up to the T-Tauri objects, the flare stars and the amazing FU Orionis type stars (called FUORS by Ambartsumian) we are confronting expansions and explosions. The very massive Trapezium systems, which in a way can reflect the process of formation of stars itself are, according to the classical works of Parengo and Ambartsumian, in expansion. The expansion age of the Trapezium in Orion determined by Parenago has a value of 10 000 years. Later, Strand, comparing the Wilhelm Struve observations with modern photographic observation of the Trapezium in Orion, derived the expansion age of 14 000 years with a mean error of 3000 years. The Orion Nebula itself, according to Kahn and Menon (1961) and then to Vandervoort (1964) based on gas-dynamical considerations indicates an expansion age of 10 000 to 20 000 years. It is proper to point out the very important work by Ambartsumian, in which he maintains that the OB and T associations have positive energies. In other words, they are in expansion.

Based on the existing hypothesis and speculations about star formation and considering the new observational data, which includes of course radio and the astronomical satellite information, it seems more and more apparent that it is quite difficult to maintain the gravitational contraction theory of star formation.

Just to put an end to this rather compact and incomplete talk, I would like to recall an informal conversation with one of our students in Mexico after he obtained, about 20 years ago, his doctoral degree in one of the most prominent universities of the United State of Anglo America:

I asked him why he maintained and believed in the gravitational contraction process for the formation of stars. He quickly answered me: because I have been educated under such direction. I just told him about an anecdote regarding Galileo when he discovered the moving Jupiter satellites and in a hurry went to visit a prominent mathematician

who was at the same time his protector and a distinguished Roman Cardinal. Galileo said: "Excellency I can now prove that Aristotle is wrong. Please come and see through my small telescope." The old (83 years) Cardinal answered: "Galileo, I am quite old and all my beliefs and intellectual life are erected on the Aristotelian basis. Please let me die in peace."

I really hope that the majority of us do not want to die, intellectually, in peace.

THE OB RUN-AWAY STARS FROM SCO-CEN AND ORION REVIEWED*

A. Blaauw

We study the past paths of the run-away star Zeta Oph from the OB association Sco-Cen, and of the run-away stars AE Aur, Mu Col and 53 Ari from the OB association Ori OB1, in connection with the question of the origin of these high velocities. Should the binary-hypothesis be adhered to (supernova explosion of one of the components) or, perhaps, dynamical evolution in young, dense clusters offer a clue to this phenomenon? It is shown that the latter hypothesis is very unlikely to apply to Zeta Oph. For the run-away stars from Orion conclusive evidence may well be obtained in the course of the next decade, from improved accuracy of the proper motions.

Introduction

In recent years, the question of the origin of the OB run-away stars has received renewed attention. In my first paper on the subject [1]. I proposed that these stars originate from close, massive binaries of which the most massive component undergoes rapid and complete (or nearly complete) mass loss, resulting in the release of the secondary component with a velocity approximately equal to its original orbital velocity. In subsequent years, this simple model was found to require reconsideration in view of the important role of mass transfer in close massive binaries. As a consequence of this mass transfer, at the time of the explosion of the primary (i.e., of the originally most massive component) so much mass may have been transferred to the secondary component that explosion of the former does not lead to loss of more than half of the total mass of the binary system. In that case the system remains bound and its systemic velocity with respect to the original center of gravity may well become considerably less than the velocity of the "single" run-away in the original scenario. The problem of the run-away OB stars in the light of the mass transfer in massive binaries has recently been reviewed by Van den Heuvel [2]. For a recent discussion of the binary-hypothesis and of the kinematics of the run-away stars see Stone [3], and for a rediscussion of observational data (particularly of newly determined radial velocities) and arguments in favor of broadening the range of possible mechanisms for the origin of this class of stars, see Gies and Bolton [4]. The latter authors suggest that especially an alternative model based on ejection of stars as a consequence of dynamical evolution of young, dense clusters merits further study.

Thus, it appears useful to have a close look at the question of how well the volume of space within an OB association in which the run-away stars have been ejected can be identified, and whether this supports, or perhaps eliminates, the possibility of such a cluster-dynamical origin. In the present paper we do this for a few objects for which the observational data are the most favorable. They are: the run-away star Zeta Ophiuchi with respect to the Sco-Cen association, and the run-away stars AE Aur, Mu Col and 53 Ari with respect to the Ori OB1 association. A number of relevant data are collected in Table 1. Our approach will be the following. Ideally, we should draw a three-dimensional picture of the spatial configuration of the parent association and

*Dedicated to Victor Ambartsumian on the occasion of his 80-th birthday.

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