

Preface

The french CNRS Schools of Solar Astrophysics held in Saint Pierre d'Oléron (France) since 1996 discuss innovative subjects for the discipline. Over the years the sets of themes selected (chaos and fractals in solar cycle activity, transport and conversion of energy in the heliosphere, news avenues for astronomical data analysis, physics of the Earth's climate, space weather) has permitted advanced students and researchers to have a vast panorama of up-to-date subjects which contribute to the prestige of astronomy and astrophysics.

The school was dedicated to the memory of Prof. Jean Rösch, a distinguished figure of French astronomy, known all around the world mainly for his contributions to solar physics. For this occasion, Prof. Georges Isaak, from Birmingham University (UK), organised a very nice plenary conference.

Both the quality of the lectures and the enthusiasm of the participants made it a very fruitful event. Moreover, the beauty of the colorful and picturesque island of Oléron as well as its peacefulness, made a wonderful setting for the school.

In keeping with the spirit of the previous schools, the goal of this one was to present a small set of topics of high current interest in solar astrophysics. The general theme adopted this time was mainly devoted to the gravitational aspects of the Sun, with one question still open: how does the time evolution of the shape of the Sun affect our understanding of the convection zone?

This book reviews eight of the major courses given during the fifth session, which took place from the 22 to 26 of May, 2000. The editor sincerely hopes that the reader will be particularly satisfied with the clarity with which the authors wrote their courses. That they are thanked for this work.

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In Honor of Jean Rösch

Testimony

This CNRS Summer School held in Oléron, devoted to Solar Astrophysics and entitled “Investigating the Sun’s surface and subsurface: shape and irradiance” is dedicated to the memory of Prof. Jean Rösch (1915-1999).

Jean Rösch died on 22 January 1999. It is incontestably a distinguished figure of the French astronomy that disappears. Having been relatively close to him all my life, it seemed to me that it was my duty to dedicate here some lines to him.

Jean Rösch was born on 18 January 1915 in Sidi-Bel-Abès (Algeria), of a physician father, of whom he spoke with a certain pride. He liked to narrate anecdotes concerning his Algerian childhood: for instance the construction of a fictitious radiology machine, made from a plate of frosted glass inside a wooden framework; the construction of his first telescope (which he set up on the Pic du Midi and that has served on various occasions, for example to determine the axes of the North pillar instruments by locating the Polar star, and that has since disappeared I do not know where), and so on. All of this showed his manual dexterity and his inventive mind. He also narrated, in a somewhat facetious fashion incidentally, the olive picking when he evoked how the servants surreptitiously diverted liters of oil for their personal consumption. He told all that very well, in a calm, posed and warm voice; with a few well selected words one could feel the life in the central square of the city, the mid-day sun, the silence of the afternoon, the respected citizens – his family was part of them - chatting at the terrace of a cafe. He liked to talk, he liked to tell many anecdotes, and he confided without doubt more in people he trusted; he liked to be listened to, and could only stand being interrupted if it was for a good question.

He liked also to be entertained, and he entertained gladly, but always with his peers; sometimes abrupt in company, he also knew how to vary his comments with a touch of humor, not detesting on rare occasions, to pull someone’s leg, but only by implication, with a repressed smile and eyes glimmering... As he was a convinced Pyrenean, the Ramon’s Society of Bagnères de Bigorre offered him a forum of exchange and conviviality entirely adapted to his life style.

I met him on 30 June 1963, when I arrived as a young student to undertake a training course at the observatory, devoted to the electronic camera. I

presented myself in his office, then located on the first floor of the building of Bagnères de Bigorre, on the corner of the left wing. What struck me most at first glance, just after the slightly sauna atmosphere of the place (wooden doors and windows, a parquet floor, wainscoting to the ceiling, a long working wooden table encumbered by papers), was the rather dry tone in which he spoke to me, without detours or convolutions, going, as he always did, right to the essential. And what I still remember, are his clear blue vivid eyes, and finally the civility with which he welcomed me. One has often described him as little surly; but I believe that this outward aspect hid in fact a greater generosity than appeared. He was a man of society in the sense that he placed the values of traditional morals very high. Gallant with ladies, on the condition they remained in their place. Capable of giving, on condition that one did not betray him: how many times I have heard him say: *“M. So-and-So doesn't know what gratitude is”*.

Student of the “Ecole Normale Supérieure” –the ENS– a school, as he said pleasantly, “so-called Normal and allegedly Superior”), he discovered astronomy on a training course within the laboratory of Bernard Lyot at the Meudon Observatory. The course of his life was consequently plotted out: his Ph. D. thesis prepared and submitted at the Bordeaux Observatory, the direction of the Pic du Midi Observatory (obtained from the Ministry, in competition with Dauvilliers, a Professor at the prestigious College de France in Paris; at that time the appointments as positions of Director of an Observatory were made directly by the Minister and not following an elected process as now), and then the astronomy professorate at the University of Paris. One could stop there. In a career, this cursus is already more than honorable; but there is more than the route, there is also the manner in which one fills it.

As a researcher, Jean Rösch was a rigorous scientist. He was the author of remarkable works, notably on the quality of the astronomical sites, the atmospheric turbulence and the high angular resolution, on the solar granulation, on the solar corona. Curious, he was deeply involved in all the observational astronomy, from planetary images to the cosmic radiation. He travelled all over the world searching for astronomical sites, if not ideal, at least the best, going from the Sierra Nevada in Spain to the Andes Cordillera in Chile, on behalf of the “Institut National d’Astronomie et de Géophysique” (INAG) or within the framework of the Joint Organization for Solar Observatories (JOSO). During his whole career he attended nearly all the General Assemblies of the International Astronomical Union, and he was able to recall them (geographically and temporally) in the exact order, quoting here an anecdote with an American colleague, quoting there another with another colleague. It is quite annoying that I did not record all this: there would have been there a small anthology of the entire astronomer planet.

Excellent physicist, he was particularly gifted for celestial mechanics, able to see in space with an acuteness that has always surprised me. Maybe this was due to the reminiscences of the teaching of the descriptive geometry in classes of

“taupe”¹ at the time he was a student in Alger... But his field of predilection was optics. He mastered all the aspects, theoretical as well as experimental. Together with Marcel Hugon, an astronomer, or François Chauveau, an engineer, leaning over an instrument they were developing, he analyzed the optical process with a methodical and chilly rigour, dissecting it physically until it spoke, that is to say until finding the fault. He transmitted to me the secrets of the coronagraph, and those of his scanning heliometer. I must confess to having had pleasure observing with him. But beware of his acerbic reaction if, the head down and the eye stuck at the ocular, a finger pressure on the regulating level in the right ascension did not correspond at the first attempt to the exact direction anticipated by the theory!

As a Professor, he was an exceptional master for his students, sometimes badly loved, because very strict, but strict for the right reasons: rigour was the master word ... Endowed with a prodigious memory, he had apparently and according to what has been told to me, only once left the Mineur Amphitheatre inside the “Institut d’Astrophysique de Paris” before the end of the lecture, vexed at being unable to remember a formula by heart that escaped his memory and not wanting to give the annoying impression of having to look it up in his notes. It is this uncommon memory that made him able to restore with an extraordinary precision an old fact dating from several years ago; he detested people saying they could not remember... For a researcher, is not the memory a working tool?

Nevertheless, it should be noted that this Parisian teaching obliged him to do an incalculable number of return trips Lourdes-Paris, in sleeper trains, to avoid lose of time. I made sometimes the journey with him, but in the lower bunk and him in the upper one: *“it is necessary to respect the hierarchy”*, he said, not without wit. What with climbs up the Pic du Midi, as frequent as once a week, his foreign travels, his teaching and his Parisian committee’s life, one can say that he was particularly active. Fortunately, the very devoted Mrs. Bousquet took care of everything in Paris, his outside appointments, his diary of numerous thesis juries, his meetings. He had given a lot of himself, for the cause of astronomy, accepting multiple tasks, sitting in multiple advising committees of the profession. Member of the section 7, a scientific committee within the CNRS at the moment of May 1968, he had kept a rather waggish image of this period, where manifestly the idea of disorder was not appropriate to him. But it did not displease him, when the opportunity arose, to give his own version of the facts, approving of the men and their characters, but approving a little less the ideas that nevertheless made History.

In June 1973, he was going to observe a solar eclipse in Mauritania, an eclipse of an exceptional duration. Coordinator of the French team, he deployed a tireless zeal for the success of the operation, both on the ground and in the sky, since, as it must be reminded, the eclipse was followed by the Concord 001, piloted by A. Turcat himself. He fought with administrative authorizations, rectifying here an

¹ the name “taupe” designs in French the student classes which prepare to the entrance in Higher Schools of Engineers.

error due to a too intrepid colleague who wanted to convey the equipment too rapidly not yet cleared through customs, extolling there to the local authorities the interest of the scientific mission, struggling in a nonchalant sphere absolutely unfazed by deadline dates. He did that willingly without mincing his efforts, and undoubtedly more in the interest of astronomy than that of the collectivity.

Is it there that he contracted the first symptoms of a rare sickness? His close relations think so, but he was not so convinced himself. The fact remains that a short while after, he was suddenly particularly weakened physically and a rather spectacular thinness affected him. This severe consumption lasted rather a long time, the Parisian medicine misdiagnosed it. Between two hospital stays, he came back one day to Bagnères de Bigorre and Eugène Laporte, the chauffeur during this period, who came to wait for him on the tarmac of the airport of Pau, concluded that he was near the end. Candidacies to his succession gushed then at a fast rate... But in fact the remedy was found and from then one saw him follow a very strict diet, taking his corn bread everywhere, to the Pic du Midi as well as to the restaurant. He watched his diet scrupulously, because his life depended upon it.

His work, of course, is the Pic du Midi Observatory. It would be necessary to write entire pages to tell the whole epic; other writers did that under various forms. Pages and pages have been published, some of them ripped up at the author's death; but the truth remembers blurred, and the re-transcriptions are less and less faithful. It is a pity that he did not record his own vision, during the course of a direction that was exceptionally long: *"I would have to speak too badly about my fellow being"* he retorted when one asked him to do so...

Jean Rösch was inexhaustible as soon as somebody spoke about the Pic du Midi. Since his childhood holidays when he had drawn the silhouette of this so characteristic summit from the window of his grandmother's home, up to well after his retirement when he was still fascinated by perpetually changing landscapes of the high mountain, to this day of climbing where he was welcomed by Garrigue, a somewhat insane physicist who told him: *"I will kill the cat and I will kill you the next time you come back"* (H. Camichel, an astronomer working at the Pic du Midi observatory in those days and who told me this story, added that J. Rösch felt a little embarrassed at this idea). This Pic du Midi that one qualifies as before and after the electricity era, before and after the cable car era, and as one will report in some time, before and after the tourist era. A particular atmosphere reigned there, where psychology intervened, even inter-acted: eight days under the clouds at the Saint-Michel de Provence Observatory do not produce the same effect as eight days in the clouds at the summit of the Pic du Midi Observatory... But it is there that remarkable solar observations were made, by people as prestigious as J.C. Pecker or R. Michard, and of course by B. Lyot himself. And Rösch had no rest until instrumental platforms were installed for these observers, as soon as the scientific interest was clearly established: the dome Michard for a new solar spectrograph, another one for a small coronagraph, a new solar equatorial table in the vast Baillaud's dome, the turret dome, the Charvin's dome for the Lyot's coronameter, the tower and

the dome of the Bernard Lyot telescope, the arrangement of the 1-m telescope (refurbishing of the mirror through a NASA contract), a small 55-cm telescope to study the zodiacal light. He refurbished also the life base, even if the search of comfort was not his first objective. Bedrooms were hardly comfortable, the dining hall of a rather mediocre aspect, in spite of the armory of the Pic, drawn by Jean Rösch himself, occupying the place of honor at the top of the South wall, with this slogan found in a work of Brillat Savarin on the Physiology of Taste: *“the discovery of a star does more for the happiness of mankind than the discovery of a new meal”*.



Fig. 1. Jean Rösch and the author working at the scanning Heliometer at the Pic du Midi Observatory (turret dome) in April 1995.

His last realization was the scanning heliometer (see Fig. 1), an idea born judiciously in the course of a discussion held inside the section 7, a CNRS committee in 1969. R. Dicke, from Princeton University had just published an article on the solar flattening in the “Physical Review Letters”. Evry Schatzman, another member of this committee told then Jean Rösch: *“if R. Dicke is capable of measuring a solar flattening at an elevation around the sea level, one must be capable of measuring it with a higher precision at the Pic du Midi”*. And this is quite true as now we were able to measure, in 1996, a flattening of 8.9 milli-second of arc, while from the MIDI experiment on board SOHO, a flattening of 6.3 milli-second of arc was found over the same period. It is undoubtedly regrettable that such a long time went by before the instrument filled its mission: it will have been necessary to wait until 1993 in order that a team composed of Jean Rösch, Hervé Deslandes, Valérie Desnoux and myself could finally change all the electronics, developing all adequate software, completely renovating the instrument to make it capable of taking advantage of the East crest of the Pic

du Midi. That is indeed an ideal site where we have obtained the diffraction limit of the 50-cm telescope several times (it is also the reason for the quality of measurements obtained). But the basic principle of the scanning heliometer, an extremely ingenious apparatus, remains that of Jean Rösch: the optical concept of course, with the rhomboedras, a mirror cube, an internal calibration -astute optics-, a processing method by means of a solar edge deconvolution in order to take account of the seeing in real time. The only thing that he will not have seen, is the possibility to perform continuous measurements, that is to say all around the Sun, to determine the shape of the Sun (the heloid) and thus to have access to the successive gravitational moments: quadrupole, hexadecapole, etc., with the underlying cortege of astrophysical implications. But I suspect that this was of lesser interest to him than to meticulously prepare an opto-mechanical mechanism to “slice” the Sun in successive cords to be sure to pass through a diameter.

I climbed the Pic for the last time with him on 23 rd April of 1995. The preceding year, on 26 th, July 1994, I made with him, by foot, the last ascent from the “Laquets”, after being descended by the cable car from the T2m (the 2-meter telescope on the West side of the summit). We took our time, stopping at each bend, North-West crest, South-West crest; when coming back to Bagnères de Bigorre a few days later, Richard Muller said to me: *“you want to kill him”*. During this ascent by foot he told me a lot of stories, of the Pic du Midi, of his Pic... Of the solar corona, of the granulation where his personal contribution was notable, contributing for example to the discovery of pores, the compensation in real time of atmospheric effects (an initial article written by him dates nevertheless from 1972, therefore well in advance in comparison to all the other articles on adaptive optics). By evoking the death of Green (an English physicist from Manchester University, a man from the Nobel Prize Blackett team), on the road from the Tourmalet up to Sencours, I told myself that he would have liked to die on the top of the Pic, but not the Pic of the present years, neither those of the first cable car years, but the one of the glorious years, when ascent must be done by foot. He had never approved of the tourist and museum projects of the Pic, estimating that the scientific area was given the minimum grant, even by keeping the two major realizations, the T2-m on one side and the turret dome on the other one (by the way an idea of J. Rösch which has been taken up again for the dome of the solar telescope of THEMIS at the peak of Teide in Canarian Islands). He had also never appreciated the “inter-ministerial” building episode in which he had never even set foot, out of principle, out of pride, even when he showed a new Prefect or a Member of Parliament around “his” Pic.

Scientific honors did not always come his way, undoubtedly because he was a bit too abrupt and yielded only with difficulty on what he estimated to be good. A few prizes and distinctions rewarded a whole life devoted to the cause of astronomy. To the science, but also to a number of men: one cannot ignore the energy that Jean Rösch mobilized to find wages for people working for the Pic du Midi. He found some temporary work for Mr. Gentili who had been very rich before the war but who was bankrupted by it, and who worked observing the solar

corona benevolently. He also took care of people who worked in “téléphériques” positions (that is positions which were paid for by the income from the winter season of the La Mongie ski resort). These people were then taken on within the French CNRS Agency. He also helped out students who he encouraged to take part in various commissions and who then went on to become researchers. All of this was not done without a certain amount of aggravation but I do not think looking backward, that one could paint a black picture of the situation.

Jean Rösch was undeniably a great scientist and a great researcher; all his friends, all his students know they owe him a lot. I sincerely hope that the new Pic du Midi, that of this new century, will be very grateful to him.

Jean-Pierre Rozelot
Astronomer

To this testimony, it must be added the conference delivered by Prof. George Isaak, during the meeting.

To J.P. Rozelot

Thank you for the invitation to the memorial meeting for Jean Rösch. I feel honored to be asked and it is my privilege and duty to pay tribute to a scientist in the true sense of the word- a man who facilitated the execution of scientific research without thinking of what he gets out of it... a rare person indeed in this day and age.

With many thanks.

Prof. George Isaak

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