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The Interstellar ^{7}Li/^{6}Li Ratio

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Abstract. We discuss the observational status of the interstellar lithium isotopic ratio and its significance with respect to the galactic evolution of lithium.

1. Introduction.

This talk discusses the observational status of the lithium isotopic ratio in the interstellar medium (ISM). Although only four such measurements have been performed up to now, this discussion justifies itself in that the value of the interstellar ^{7}Li/^{6}Li ratio may have some drastic consequences on the galactic evolution of lithium. Moreover it will be shown that the published values of the interstellar ^{7}Li/^{6}Li ratio cannot be considered as representative values for the ISM. In a first part, we therefore review, discuss, criticize and, where possible, correct each of those measurements in order to draw a preliminary observational status of this quantity. We then present the analysis and the results of new high quality observations of this ratio on a previously observed line of sight, and discuss the extreme consequences of the atypical values derived. A complete observational status of the interstellar ^{7}Li/^{6}Li ratio and its significance with respect to the galactic evolution of lithium are given as a conclusion. Before proceeding with this review however, let us briefly outline the purpose and basic significance of interstellar ^{7}Li/^{6}Li ratio measurements.

Lithium–7 is now generally accepted to originate in the hot Big Bang primordial nucleosynthesis (BBN), with a primordial abundance (^{7}Li/H)$\simeq 10^{-10}$ (Smith et al., 1993), in excellent agreement with the observed uniformity of the ^{7}Li abundance in very metal deficient Pop II stars (^{7}Li/H)=1.4$\times 10^{-10}$ (Spite et al., 1993). During the galactic evolution, both lithium isotopes are created by spallation reactions of galactic cosmic rays (GCR) interacting with the ISM, that yield (^{7}Li/H)$\simeq 2. \times 10^{-10}$ in 10 Gyrs, with a production ratio (^{7}Li/^{6}Li)$_{GCR}$=1.4 (Meneguzzi et al., 1975; Reeves, 1994). The major problem in understanding the evolution of lithium in the Galaxy is to explain the observed Pop I abundance of ^{7}Li, (^{7}Li/H)$_{PopI} \sim 10^{-9}$, of which only 30% is accounted for by BBN and GCR spallation mechanisms, as well as the high ^{7}Li/^{6}Li ratio measured in meteorites, representative of the solar system formation epoch 4.6 Gyrs ago, (^{7}Li/^{6}Li)$_\odot$=12.3, whereas the above mechanisms predict a ratio around 2. In order to account for these two quantities, the existence of an extra source of ^{7}Li of stellar origin has been suggested, AGB C and S stars being the best candidates as they are observed to be super Li–rich (Abia et al., 1993; Abia et al., 1994; see also Mowlavi, 1994, for the production of ^{7}Li in AGB stars). It was argued by Reeves (1993) from the comparison of the meteoritic (^{7}Li/^{6}Li)$_\odot$ ratio and the production rates ratio in GCR spallation reactions that GCR spallation alone tends to decrease the ^{7}Li/^{6}Li ratio with time, and that, starting 4.6 Gyrs ago with a ratio ^{7}Li/^{6}Li =12.3, one should observe today an interstellar ratio ^{7}Li/^{6}Li $\simeq$5–6 without production of ^{7}Li in stars, or ^{7}Li/^{6}Li $\gtrsim$6 with stellar production of ^{7}Li. Measuring the interstellar ^{7}Li/^{6}Li ratio thus provides a key test for the model of galactic lithium evolution. If this ratio is found to be ^{7}Li/^{6}Li $\lesssim$5, then another scenario would have to be considered; one way out would be to consider a primordial abundance (^{7}Li/H)$\gtrsim 10^{-9}$ together with some

form of internal mixing that could very well reproduce the observed "Spite plateau" in Pop II stars (Pinseonneault et al., 1992) and some rotational mechanisms to reproduce *via* a gradual depletion of lithium in stars the observed abundances of ^{7}Li in stars of different metallicities (Vauclair, 1988). As to now however, there is no obvious way of reproducing a primordial abundance as high as 10^{-9} since the inhomogeneous nucleosynthesis models involved up to a few years ago to yield such abundances no longer do (Reeves, 1994; Thomas et al., 1994).

2. Previous Measurements

The fact that there are so few measurements of such an important quantity as the interstellar ^{7}Li/^{6}Li ratio is simply due to the difficulty one has to face to detect the ^{6}Li isotope. The only accessible resonance lines of lithium form a transition doublet of ^{7}LiI at 6707.761–6707.912 Å, with a similar doublet for ^{6}LiI redshifted by 0.160 Å. In regards of the low abundance of lithium and the nearly complete ionisation of lithium to LiII in the ISM, the strongest equivalent widths observed for the 6708 Å line of ^{7}LiI are of a few mÅ on lines of sight already comprising a hydrogen column density well over 10^{20} cm^{-2} (White, 1986). The structure of the transition is such that the main component of the ^{6}LiI doublet is completely superimposed on the weaker component of the corresponding ^{7}LiI doublet. Therefore, the only absorbing line of ^{6}Li that one may hope to detect is the weaker one. Assuming a ratio ^{7}Li/^{6}Li $\simeq$ 10, the oscillator strengths ratio of the doublet components being 2, the typical equivalent width of this line is $\sim$ 30 μÅ, which corresponds to a resolution element of 67 mÅ (i.e. a resolving power $\lambda/\Delta\lambda=10^5$) lowered from the continuum by 0.04%... Moreover, on lines of sight showing a column density N(HI)$\gtrsim$ 10^{20} cm^{-2}, several interstellar components separated by $\sim$5 km.s^{-1} are often present so that the resulting absorption profile of the LiI transition doublet may be very complex (the isotopic shift of the doublets is 7.2 km.s^{-1}).

A simulation of this resulting profile corresponding to our best fit solution for the ζ Oph line of sight is shown in Fig.1 as the solid line, the individual contributions for ^{7}Li and ^{6}Li of each of the two interstellar absorbing clouds being shown in dashed line. Obviously, in order to detect ^{6}Li and derive a ^{7}Li/^{6}Li ratio as accurate as possible, one needs to observe a bright target with a line of sight as dense as possible and whose velocity structure must be as trivial as possible. It is also necessary to observe hot stars so that the lithium region be not contaminated by stellar lines of other elements. Naturally, the number of such targets comes down to a few. One needs also to reduce the data with care in order to avoid any instrumental pollution of the profile. Finally, it is necessary to use sophisticated profile fitting methods in order to probe the observed profile for all

the contributions shown in Fig.1, since neglecting one of them would mean neglecting a contribution of the order of the ^{6}Li absorption one is looking for.

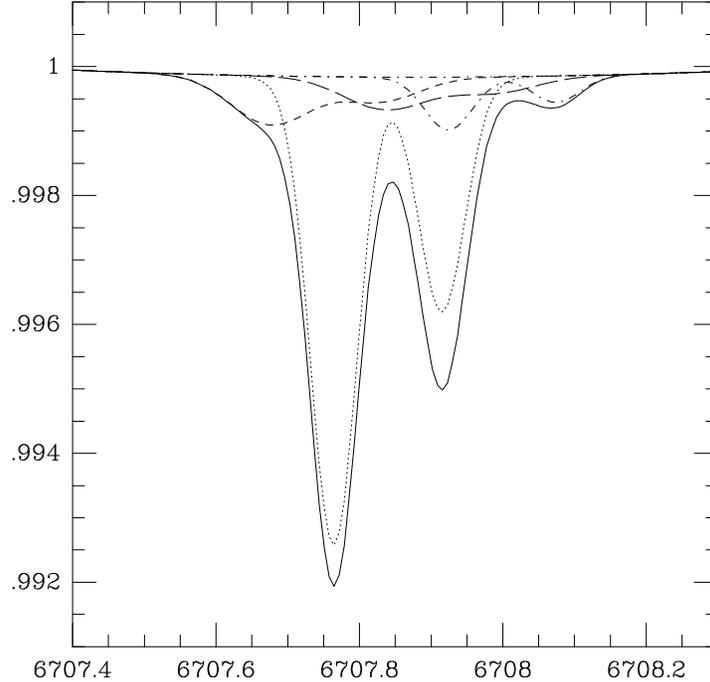**Fig.1:** Simulation of the observed profile of the $\lambda6708$ Å LiI line as taken from our best fit solution in the direction of ζ Oph (solid line). The individual contributions of the two absorbing clouds A and B are shown as: dotted line ^{7}Li$_A$, short dash ^{7}Li$_B$, dot–dash ^{6}Li$_A$, long dash ^{6}Li$_B$. Note that the profile in solid line would only be observed if the S/N and the sampling were already infinite.

Nevertheless, the first estimation of the interstellar ^{7}Li/^{6}Li ratio was attempted ten years ago by Ferlet & Dennefeld (1984, hereafter FD) in the direction of ζ Oph using the Coudé Echelle Spectrometer (CES) at the ESO 1.4m Coudé Auxiliary Telescope and a Reticon detector. Although they obtained high quality data with a resolving power $\lambda/\Delta\lambda=10^5$ and a signal-to-noise ratio per pixel S/N=4000, ^{6}Li was actually not detected for that time. We will therefore not discuss further the value obtained for the main absorbing cloud:

$$^7\text{Li}/^6\text{Li} \gtrsim 25 \ (\sim 38)$$

The first actual detection of ^{6}Li was reported by our group (Lemoine et al., 1993, hereafter L93) in the direction of ρ Oph. The observations were conducted at ESO using the 3.6m Telescope linked via fiber optics to the CES, providing a resolving power $\lambda/\Delta\lambda=10^5$ and a signal-to-noise ratio S/N$\sim$ 4000 per pixel of a CCD detector. The KI $\lambda7699$ Å line was also observed since LiI and KI are known to behave similarly in the ISM (White, 1986).

The typical equivalent width of the KI line is also much stronger than that of the LiI line at 6708 Å, and thus allows to derive an accurate velocity structure of the line of sight. Two interstellar absorbing clouds, one main (A) and one weak (B) were detected, but only the ^{7}Li/^{6}Li ratio in cloud A was evaluated, yielding:

$$^7\text{Li}/^6\text{Li} = 12.5^{+4.3}_{-3.4} \ (2\sigma)$$

This value was immediately interpreted by Reeves (1993) as strong evidence for the existence of an extra source of ^{7}Li. The only critics we would address to this measurement is that, due to numerical complexity and to the weakness of the B component in ^{7}Li, the ^{6}Li$_B$ contribution was neglected. Using a more sophisticated profile fitting algorithm (to be shortly discussed in 3.), we were able recently to re-analyze this line of sight, and the following ratios were derived taking into account all detected contributions:

$$\left(^7\text{Li}/^6\text{Li}\right)_A = 11.1$$

$$\left(^7\text{Li}/^6\text{Li}\right)_B \sim 3$$

The error bar on the ^{7}Li/^{6}Li $_A$ ratio is to remain as previously, i.e. ± 2 at 1σ, but the $(^7\text{Li}/^6\text{Li})_B$ ratio is uncertain since ^{6}Li$_B$ is not formally detected above the photon noise. The fit is shown in Fig.2, the corresponding χ^2 is 37.4/43 giving a level of confidence of 71%.

Meyer, Hawkins & Wright (1993, hereafter MHW) reported shortly thereafter ^{7}Li/^{6}Li $=6.8^{+1.4}_{-1.7}$ toward ζ Oph, and ^{7}Li/^{6}Li $=5.5^{+1.3}_{-1.1}$ toward ζ Per, values which cast severe doubt as to the existence of a stellar source of ^{7}Li, hence on the "canonical" scenario for the galactic evolution of lithium. The data were obtained at the KPNO 0.9m telescope at a high quality, with $\lambda/\Delta\lambda \simeq 2$–$3\times10^5$ and S/N$\simeq$ 2000 per pixel. These results seem to us to be questionable for the following reason. It is obvious from the MHW spectra that at least two absorbing clouds are well detected in ^{7}Li toward each of the two targets, and only the main component was taken into account in the profile fitting in each case. It is in fact well known that toward ζ Oph and ζ Per, several interstellar components are indeed present (Welty et al., 1994). Recalling the discussion above, these values seem to be biased, and are at most average values of the ^{7}Li/^{6}Li ratio on the lines of sight, hence *a priori* not representative of the general ISM. It happens moreover that the new data we discuss in 3. were also obtained in the direction of ζ Oph. We derive a ratio ^{7}Li/^{6}Li $\simeq 9.8$ when looking for a one cloud solution, with a χ^2 of 303/13 and 103/58 for the KI line and the LiI line respectively, i.e. respective confidence levels of 0% and 0% because of the non-negligible presence of a second absorbing cloud. This result is in slight agreement with that derived by MHW albeit higher, suggesting that an average value for

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the ^{7}Li/^{6}Li ratio on this line sight would lie closer to 8–9 than to 6–7. For similar reasons, we are led to believe that the value derived toward ζ Per is not representative either of the ^{7}Li/^{6}Li ratios on this line of sight. These data are of a such quality that they would deserve being re-analyzed in more detail, as we did for ρ Oph.
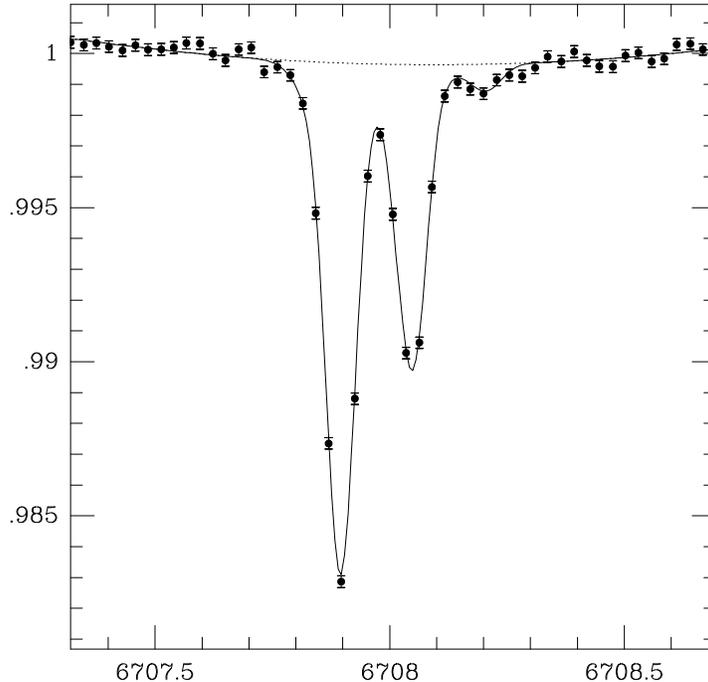

Fig.2: Best fit solution for the ρ Oph line of sight including all ^{7}Li and ^{6}Li contributions for two interstellar absorbing components. Error bars are 1σ. The level of confidence of the fit is 71%.

In the end, among these four measurements of the interstellar ^{7}Li/^{6}Li ratio, it seems that only the values derived and corrected toward ρ Oph may be kept, i.e. ^{7}Li/^{6}Li $\simeq$ 11.1 ± 2, with an uncertain value ^{7}Li/^{6}Li ~ 3 to be confirmed or not. The values derived by MHW do not seem to be representative, and the data should be re-analyzed in more detail, as their high spectral resolution and high signal-to-noise ratio would for sure allow accurate estimations of probably two ^{7}Li/^{6}Li ratios on each of the two lines of sight.

3. New data toward ζ Oph

We obtained new data of the $\lambda6708$ Å LiI line toward ζ Oph at the ESO 3.6m Telescope linked to the CES with fiber optics. ζ Oph had already been observed by FD and MHW, yielding two very different values for the ^{7}Li/^{6}Li ratio. Our data revealed to be of a higher quality, showing $\lambda/\Delta\lambda=10^5$ together with S/N=7500 per pixel. The data were

carefully reduced using different approaches in order to estimate the importance of systematics on the LiI profile, hence on the ^{7}Li/^{6}Li ratios. Indeed, it was found that the noise is dominated by interference fringes remnants at a level of $\sim 10^{-4}$ rms and not by the photon noise, as it can be seen from the non-gaussian statistics of the continuum in the spectrum of Fig.3. The $\lambda 7699$ Å KI line was also observed in order to link our LiI observations with KI and with others. The spectra were normalized and the continua fitted using a cross-validation statistical criterion. In order to probe the profiles for the different contributions (see Fig.1), a sophisticated profile fitting technique based on a simulated annealing minimization algorithm allowing to include all kinds of constraints on the minimization procedures, e.g. atomic and physical constraints on the parameters that define the profile, was developed. For further details on the reduction and analysis of this line of sight, the reader is referred to Lemoine et al. (1994). Two interstellar components were detected in KI and in LiI, one main (A) and one secondary (B). The limiting detectable equivalent width of the spectrum is 18 μÅ, or 50 μÅ including systematics. We were thus able to derive two ^{7}Li/^{6}Li ratios:

$$\left(^7\mathrm{Li}/^6\mathrm{Li}\right)_A = 8.6 \pm 0.8 \ (\pm 1.4)$$

$$\left(^7\mathrm{Li}/^6\mathrm{Li}\right)_B = 1.4 \ ^{+1.2}_{-0.5} \ (\pm 0.6)$$

where the error bars within brackets are associated to systematics and were estimated by fitting different sets of spectra reduced using different techniques. In fact, these numbers constitute upper limits to the systematics for they somehow include statistical errors associated with the photon noise. The fit is shown in Fig.3, the corresponding χ^2 is 50.5/54, or equivalently a level of confidence of 61%. In Fig.4 (Fig.5), we show the ^{6}Li$_A$ (^{6}Li$_B$) doublet as calculated by subtracting to the observed profile all the calculated absorption except that of the ^{6}Li$_A$ (^{6}Li$_B$) doublet. As toward ρ Oph, we find an extremely atypical ^{7}Li/^{6}Li ratio. Why is it that this ratio be so low?

It might be suggested for instance that the "strong" ^{6}Li$_B$ contribution observed is due to an instrumental effect. A mimicking absorption feature, such as an interference fringe remnant as observed in emission on the blue and red sides of the doublet (see Fig.3), would indeed provide more ^{6}Li$_B$ absorption than real and thus imply a low ^{7}Li/^{6}Li ratio. However, as it may be seen from Fig.5, the ^{6}Li$_B$ doublet is detected above the noise, and appears at the right position with seemingly good oscillator strengths ratio and fine structure shift of the lines. This makes the presence of an extra instrumental feature very improbable. Other systematic effects, such as the contamination of the profile by cosmics, were carefully looked for in individual spectra, and none was found.
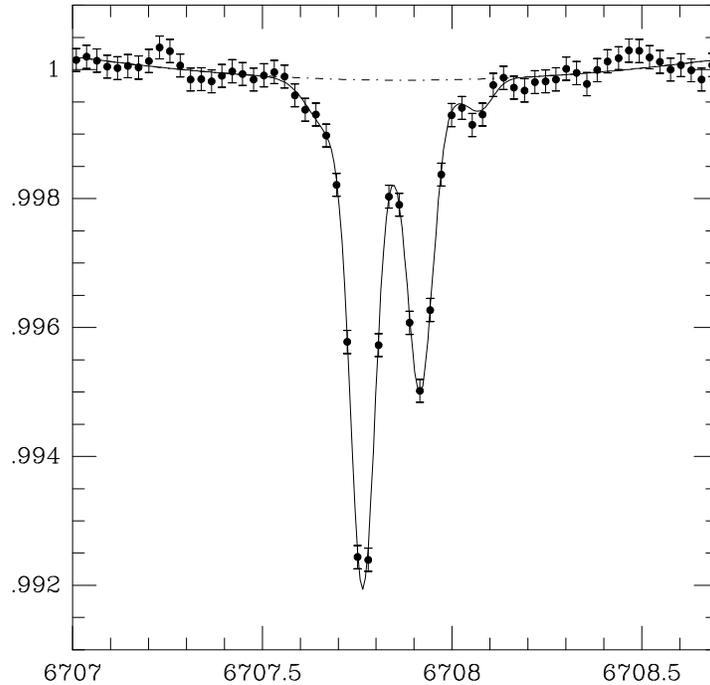
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Fig.3: Best fit solution for the ζ Oph line of sight, including two absorbing components. The level of confidence is now 61%.

Another way to excuse this atypically low ratio would be to assume the presence of a high radial velocity cloud absorbing in ^{7}LiI at the position of the ^{6}Li$_B$ ratio, which would mimic perfectly the doublet structure of the line. This may be checked by introducing in the observed KI profile an absorption redshifted so as to correspond to a ^{7}LiI$_C$ doublet matching the ^{6}LiI$_B$ absorption (see L93). This in fact partly possible from our KI spectrum since the redshifted absorption takes place in the red wing of the KI profile (see Fig.10b, Lemoine et al., 1994). This is not the case for cloud A, where a similar contamination of the ^{6}Li$_A$ doublet is strictly ruled out. It is well known that many absorbing clouds are present on the ζ Oph line of sight (see Welty et al., 1994, NaI observations), but as to whether these other absorbing clouds contribute in ^{7}LiI is another matter. Only extremely high resolution observations of the KI profile may help, and these were underway at the AAT in June 1994; very preliminary results will be discussed in the epilogue. Although this explanation is attractive, it would however not explain the atypical LiI/KI ratio observed in cloud B: it was shown that the LiI/KI ratio is rather constant around 3.10^{-3} in the ISM (White, 1986), as it is observed in cloud A for instance, whereas that in cloud B is $\simeq 0.03$. There is no reason why a third absorbing cloud would explain this abnormal ratio since the LiI column density in cloud B is derived mainly from the ^{7}Li$_B$ doublet, which could not be contaminated by the ^{7}Li$_C$ line. Finally, although our combination S/N–$\lambda/\Delta\lambda$ did not

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allow to look with confidence for more than two absorbing clouds, we nevertheless tried 3 cloud solutions in different configurations and in each case, there was no way to escape having one of the ^{7}Li/^{6}Li ratios around 2–3.

The only standard way to obtain a ratio as low as $\sim$2 in the ISM comes through a massive interaction of the GCR with the material of cloud B. Using the calculations of Reeves (1993), Steigman (1993), one may evaluate that a burst of GCR spallation over 10^6 yrs is required with an enhancement of the GCR flux by a factor $\zeta \sim 2 \times 10^4$ to reproduce a ratio of 2, and $\zeta \sim 2 \times 10^5$ for a ratio 1.5. Such an enhancement is so enormous that it would make ζ Oph a γ–ray source with a flux detectable above the present instrumental thresholds, which has not been reported as yet. Still, this would explain in a natural way the LiI/KI ratio measured in cloud B, as in this scenario one should expect to measure a ratio $(LiI/KI)_B \sim (1 + 10^{-4}\zeta)(LiI/KI)_A$, the factor 10^{-4} arising from the ratio of the duration of the burst to the age of the Galaxy. This scenario seems unrealistic as for now, but one should note that the calculations are extremely coarse in that they assume a magnification of the whole GCR proton flux spectrum, and not simply the presence of a low-energy excess for instance (Meneguzzi et al., 1975).
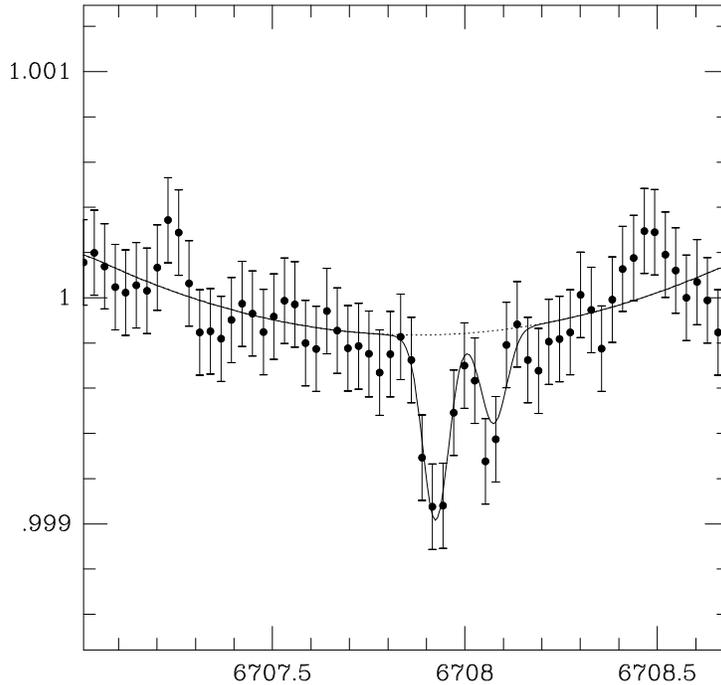

Fig.4: After subtracting all calculated contributions to the observed profile of Fig.3 except that of the ^{6}Li$_A$ doublet, this latter is shown here as residuals. The solid line shows the fit to this doublet calculated in Fig.3.
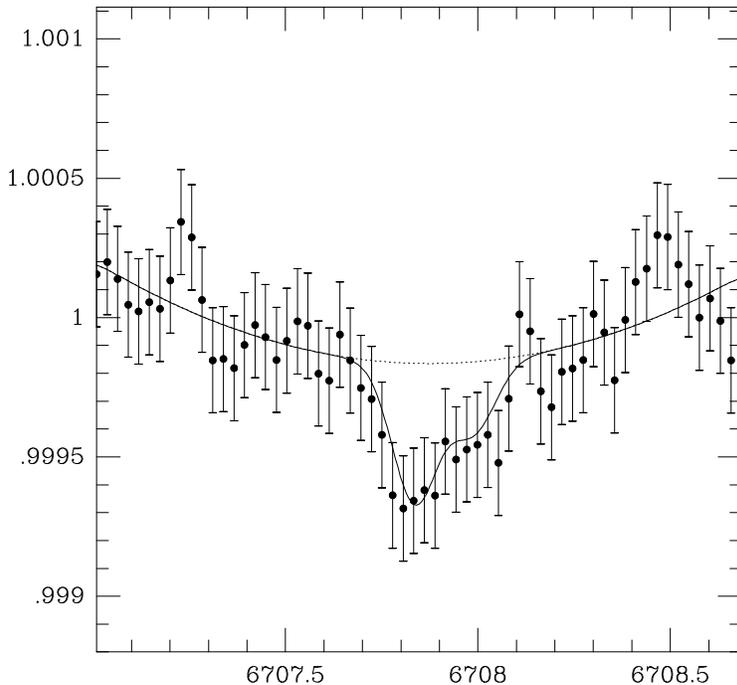
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Fig.5: Same as in Fig.5, but for the $^6\mathrm{Li}_B$ doublet. Note the scale in ordinates.

Of course, the $(^7\mathrm{Li}/^6\mathrm{Li})_A$ ratio now depends on the suggestions presented to account for the $(^7\mathrm{Li}/^6\mathrm{Li})_B$ ratio, although none of them appears entirely satisfactory. In each case however, one should expect that the actual $(^7\mathrm{Li}/^6\mathrm{Li})_A$ ratio be higher than what is measured, viz. $(^7\mathrm{Li}/^6\mathrm{Li})_A \gtrsim 8.6$. Our final results toward ζ Oph are thus:

$$\left(^7\mathrm{Li}/^6\mathrm{Li}\right)_A \gtrsim 8.6$$

$$\left(^7\mathrm{Li}/^6\mathrm{Li}\right)_B \sim 2 \text{ (unexplained?)}$$

Very recently, Cassé, Vangioni-Flam & Lehoucq (1994) offered a very elegant explanation to the $(^7\mathrm{Li}/^6\mathrm{Li})_B$ ratio. They have interpreted the recent detection of an extremely high γ–ray flux in Orion as due to the interaction of accelerated α and $^{16}\mathrm{O}$ nuclei with the ISM. They showed that a SNII exploding inside an interstellar cloud would indeed accelerate such nuclei, which are typical yields of a massive star, and through interaction with the ISM would produce $^7\mathrm{Li}$ and $^6\mathrm{Li}$ isotopes, among others, with a production ratio $^7\mathrm{Li}/^6\mathrm{Li} \simeq 3$ depending on certain parameters. It happens that although this interaction process should last $\Delta\mathrm{t} \simeq 10^5$ yrs, its efficiency in creating Li atoms is some 10^6 times that of usual GCR spallation, and this is precisely the $\zeta \times \Delta\mathrm{t}$ factor we were looking for above. This efficiency results from the very low thresholds of α–α reactions, the shape of the energy spectrum, and the weak ionization losses of α nuclei when propagating in the ISM. Assuming now

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that cloud B is a fragment of an interstellar cloud irradiated *via* this process, one should expect to measure $(^7\mathrm{Li}/^6\mathrm{Li})_B \sim 3$, and $(\mathrm{LiI}/\mathrm{KI})_B \simeq 11$, which is indeed very satisfying!

Finally, Crane & Lambert (private communication) obtained lithium data at the MacDonald 2.7m in the direction of ζ Oph, with S/N$\simeq 2000$ and $\lambda/\Delta\lambda=1.25\times10^5$. They report the presence of two interstellar components with $^7\mathrm{Li}/^6\mathrm{Li}$ ratios above 10 in each, though the secondary component is endowed with a thermal width b$\sim$ 13 km.s^{-1}, i.e. far above what is typically observed (a few km.s^{-1}). Our solution also provides a good fit to their data, which in turn argues against an instrumental contamination.

4. Conclusions & Epilogue

Previous measurements of the interstellar $^7\mathrm{Li}/^6\mathrm{Li}$ ratio were discussed and criticized in turn, and new data on an already observed line of sight were presented. At the end, the observational status of this important isotopic ratio restrains itself to the following:

$$\left(^7\mathrm{Li}/^6\mathrm{Li}\right) = 11.1 \pm 2 \ \ (\rho\,\mathrm{Oph})$$

$$\left(^7\mathrm{Li}/^6\mathrm{Li}\right) \gtrsim 8.6 \ \ (\zeta\,\mathrm{Oph})$$

$$\left(^7\mathrm{Li}/^6\mathrm{Li}\right) \sim 2 \ \ (\rho, \zeta\,\mathrm{Oph, to\,be\,confirmed?})$$

The measurements of MHW in the directions of ζ Per were shown to be biased because all the detected ISM components were not taken into account in the profile fitting. The lower limit $^7\mathrm{Li}/^6\mathrm{Li} \gtrsim 25$ obtained by FD toward ζ Oph is unexplained. A $^7\mathrm{Li}/^6\mathrm{Li}$ ratio in the secondary cloud detected toward ρ Oph has to be further discussed as it was done for the $^7\mathrm{Li}/^6\mathrm{Li} =2$ ratio toward ζ Oph. This latter is not readily explained, but might be the result of a new spallation process proposed by Cassé, Vangioni-Flam & Lehoucq (1994), where α and ^{16}O nuclei accelerated in SNII would interact with the ISM to create LiBeB isotopes, among others. First calculations show that this process is much more efficient in creating the LiBeB isotopes than usual GCR spallation and compensates largely for the short duration time of the interaction. In any case, this process is to be elaborated on further and cannot be neglected any longer in studies of the galactic evolution of the light elements.

New observations of typical $^7\mathrm{Li}/^6\mathrm{Li}$ target stars were conducted in June 1994 at the Anglo-Australian Telescope using the newly commissioned Ultra High Resolution Facilities spectrograph at $\lambda/\Delta\lambda=6\times10^5$. Toward each of the observed targets ρ Oph, ζ Oph, and others, more than two interstellar components seem to be detected in KI, some of them separated by only $\simeq 1$ km.s^{-1}... This means that to derive an accurate description of the velocity structure of a studied line of sight, which is essential as shown in 2., it is in fact

mandatory to go to a resolution $\lambda/\Delta\lambda \gtrsim 3.10^5$. What this entails for the $^7\mathrm{Li}/^6\mathrm{Li}$ ratios is far more depressing: there is no hope in LiI to resolve ISM components separated by $\Delta\mathrm{v} \simeq 1 \; \mathrm{km.s}^{-1}$ because LiI is precisely a light element, and the natural width of the LiI line is thus already $\simeq 1.2 \; \mathrm{km.s}^{-1}$. Whenever the $^7\mathrm{Li}/^6\mathrm{Li}$ ratio is around 2 in one component and 20 in the other, the resulting profile will be indistinguishable from a profile obtained from a single absorbing cloud with a ratio $^7\mathrm{Li}/^6\mathrm{Li} \simeq 10...$ This means as well that the above $^7\mathrm{Li}/^6\mathrm{Li}$ ratios are average values of $^7\mathrm{Li}/^6\mathrm{Li}$ ratios in clouds with very similar radial velocities $\Delta\mathrm{v} \simeq 1 \; \mathrm{km.s}^{-1} < \lambda/\Delta\lambda$. One may however give the following considerations. First of all, obtaining a representative value of the interstellar $^7\mathrm{Li}/^6\mathrm{Li}$ ratio is no longer a matter of a few measurements. Just as for the D/H ratio on QSO lines of sight, it is a matter of statistics at a long term, and it certainly deserves the effort. If variations of the $^7\mathrm{Li}/^6\mathrm{Li}$ ratio are detected, then they must be greater in reality than what is observed, for the values measured are already averages over different absorbing clouds. This would be the trace of an inhomogenous physical process of $^7\mathrm{Li}$ creation, possibly the one proposed by Cassé, Vangioni-Flam & Lehoucq (1994). If no variations are detected, we may have got the right value of the interstellar $^7\mathrm{Li}/^6\mathrm{Li}$ ratio, the system is homogeneous, and after all, one may consider that two interstellar clouds separated by only $1 \; \mathrm{km.s}^{-1}$ are somehow physically linked and that they should exhibit similar $^7\mathrm{Li}/^6\mathrm{Li}$ ratios. The epilogue of this review is thus that we only see the beginning of it. Stating a ratio $^7\mathrm{Li}/^6\mathrm{Li} \sim 10$ as representative of the ISM is an attractive possibility, but it is a bit too premature.

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