and the resonance line are consistent with the computations made using a one-dimensional, homogeneous model atmosphere, thus increasing our confidence that this model represents a satisfactory average of the complex fine structure expected in metal-poor stars (Bonifacio and Molaro, 1998). The VLT and the high-resolution capabilities of the UVES spectrograph will allow to measure the Li 6104 Å Li I subordinate doublet in other much fainter population II stars, thus permitting to verify the consistency between the resonance and subordinate Li I lines on a statistically significant sample, thus achieving a more accurate measurement of the primordial Li abundance and ultimately of Ω_b.

In addition to the problems with the Li abundance determination, one must be careful about two other possible effects which are important in this context: Li production by galactic sources and Li depletion in the stars. Consider Li production first: we know that the meteoritic value is $(Li/H) = (2.04 \pm 0.19) \times 10^{-9}$, i.e. over one order of magnitude larger than that observed in the Pop II stars. Several mechanisms may contribute to raise the Li abundance from the Pop II value to the meteoritic value like spallation by cosmic rays in the ISM, production in AGB stars (Cameron-Fowler mechanism) or neutrino-induced nucleosynthesis in supernova explosions. There are several uncertainties in the various contributions, but it seems that there are no problems for a Galactic Li production of the order of 90% of the Li presently observed (Matteucci D'Antona and Timmes, 1995). Consider Li depletion next: Li is a very fragile element and can be destroyed if convection takes it down to temperatures of about 2.6×10^6 K where the Li(p,α)He reaction is effective. This is what probably happened in the sun where the Li abundance in the solar photosphere is two orders of magnitude less than the meteoritic value, and in solar metallicity field stars which show a scatter in the Li abundance of three orders of magnitude. For Pop II stars the situation is remarkably different. The Spite plateau shows no evidence for scatter in Li abundance (Bonifacio and Molaro, 1997). The surface convection zone of a metal-poor star is much shallower and more superficial than that of a solar-metallicity star of the same effective temperature probably preventing Li destruction. Standard models predict no Li depletion for metal-poor stars. Depletion is predicted by non-standard models which take into account rotational mixing or diffusion (Pinsonneault, Deliyannis and Demarque, 1992, Vauclair and Charbonnel, 1995). However, these models predict a downturn of the hot side of the Li plateau and considerable dispersion, which are not seen in the observations. This suggests that diffusion or rotational mixing do not affect significantly the Li observed at the stellar surface of metal-poor dwarfs.

Overall, the case for a primordial lithium at the value observed in the Population II stars, with no production by galactic sources or destruction inside the stars, is rather robust. The primordial yields for Li are not a monotonic function of η, due to the different contribution of the Li forming reactions at different η regimes. They show a minimum, i.e. the *Li valley.* This implies that in general a value for Li will provide two solutions for η. Only knowledge of the primordial abundance of the other light elements allows to rule out one of the two roots. The more recent value is $(Li/H) = 1.73 \pm 0.05_{stat} \pm 0.2_{syst} \times 10^{-10}$ (Bonifacio and Molaro, 1997), which gives two different values for η: $\eta = 1.7 \times 10^{-10}$, which is in agreement with the high deuterium ($D/H = 2.0 \times 10^{-4}$ Webb et al., 1997) and the low primordial helium ($Y = 0.228$ Pagel et al., 1992) and $\eta = 4.0 \times 10^{-10}$ which is in much closer agreement with the low deuterium ($D/H = 3.4 \times 10^{-5}$ Burles and Tytler, 1998) and relatively high primordial helium ($Y = 0.243$ Izotov et al., 1997). Thus a perfect concordance on the η value derived from the observations of the primordial elements has still to be found.

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Ground-Based Detection of the Isolated Neutron Star RXJ185635-3754 at V = 25.7 Mag with the Upgraded NTT

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We report the first ground-based detection of the isolated, non-pulsating neutron star RXJ185635-3754 at V = 25.7 mag, obtained with the upgraded NTT in August 1997. This object has been detected first as ROSAT source and was subsequently identified as neutron star with the HST. It is located foreground to a dark cloud, i.e. at a distance of less than 130 pc. With future VLT observations, we may be able to measure its parallax.

The unidentified ROSAT X-ray source RXJ185635-3754 has been claimed to be an isolated (i.e. not in a binary system) old neutron star (NS), because (1) it shows constant X-ray emission both on short time-scales (no pulses) as well as on long time-scales, having been detected by the Einstein Observatory Slew Survey, the ROSAT All-Sky

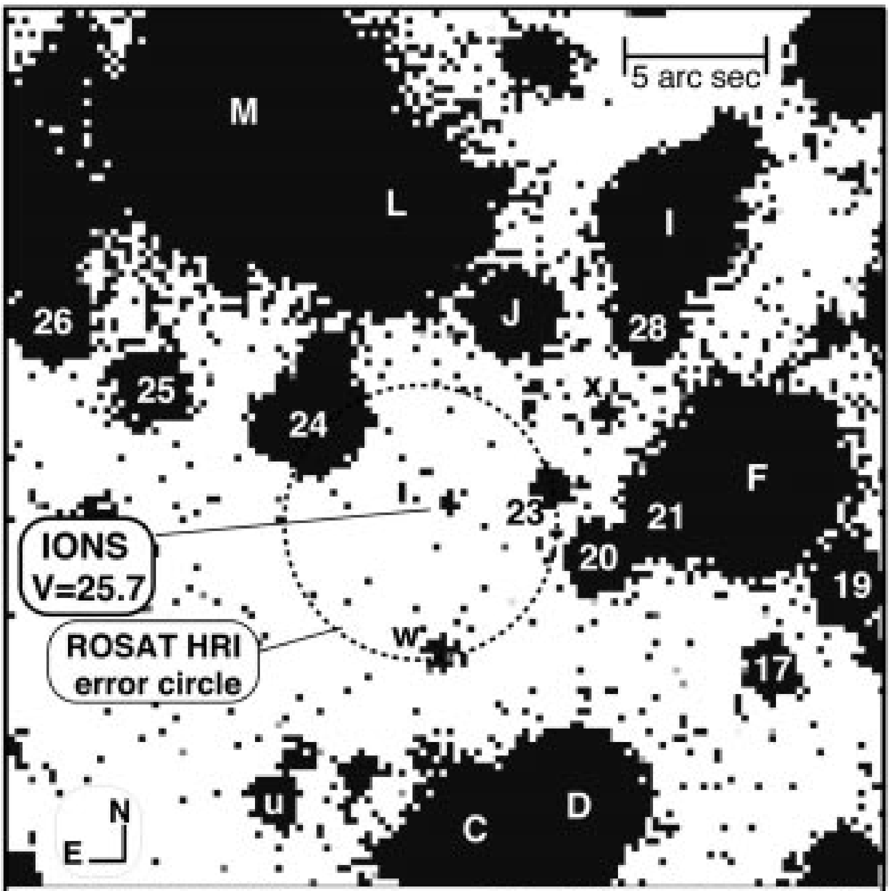
Survey, and in ROSAT PSPC and HRI pointed observations with very similar fluxes; (2) it is a very bright (3.7 ROSAT PSPC cts/sec) source with a very soft (kT = 57 eV blackbody) spectrum, as expected for an old NS; (3) no optical counterpart could be found down to V $\simeq$ 23 mag; and (4) the source appears to be projected towards the R CrA dark cloud located in Corona Australis at $\simeq$ 130 pc, and the column density from the PSPC pointing places the source foreground to this cloud (Walter et al., 1996).

By re-evaluating the boresight correction of the ROSAT HRI observation, and identifying another source in the same HRI field of view with a coronally active T Tauri star by using the B&C spectrograph at the ESO 1.52-m telescope, we have revised the X-ray position and its error circle (Neuhäuser et al., 1997). Then, a very faint star was detected in this new error circle with the HST WFPC2 with 25.6 mag at $F_{606} \simeq$ V and 24.4 mag at $F_{303} \simeq$ U (Walter & Matthews, 1997). Hence, this star is very blue, suggestive of the hot surface expected in a NS.

This object is the first example of the long-sought isolated, non-pulsating NS, of which there should be $\sim 10^8$ to 10^9 in the Galaxy, based on pulsar birth-rates and the metallicity in the interstellar medium. Its X-ray emission is due to either accretion from the ambient interstellar material (old NS) or a cooling surface (middle-aged NS). Since Bondi-Hoyle accretion scales with υ^{-3}, measurement of its velocity υ will enable us to distinguish between these alternatives. Also, since it is an isolated (i.e. single) object, we can really study the surface and atmosphere of a NS.

ESO had allocated the grey night of 1997 August 9/10 at the NTT for the detection of the optical counterpart (programme 59.D-0580, PI Neuhäuser), i.e. shortly after the start of normal operation following the NTT "big bang" upgrade. The night was photometric, but the seeing conditions (varying between 1.1 and 1.4 arc seconds during exposures in V) required us to use EMMI instead of SUSI. We used the EMMI red CCD #36, first with the ESO V-band filter #606, then with the ESO R-band filter #608. We also observed Landolt standard star fields throughout the night.

We took several images to reduce the risk of cosmic-ray contamination and placed the expected target position onto slightly different areas on the chip in each exposure to avoid problems with bad pixels. After bias and flat-field correction, we added the images using standard MIDAS procedures to construct the final V-band image with a total exposure time of 150 minutes. This image is shown in the figure (background field stars are labelled as in Neuhäuser et al., 1997, IONS indicates the location of the detected Isolated Old NS). The NS is clearly detected with a S/N of 18 inside the ROSAT error circle. The magnitude is V = 25.70 ± 0.22 mag measured with the MIDAS command magnitude/circle (and V $\simeq$ 25.72 mag with the MIDAS Romafot package).



ESO-NTT-EMMI V band image of the RXJ185635-3754 field

In addition, we have obtained images at the Cron-Cousins R-band with a total exposure of two hours towards the end of the night at air masses between 1.20 and 1.28 and seeing between 1.5 and 1.9 arc second. We could not detect the object down to R $\simeq$ 24.5 mag. The broad-band spectrum (X-ray and optical data from ROSAT, HST, and NTT) shows that the optical fluxes lie above the extrapolated pure blackbody and can best be fit with a Silicium-ash model atmosphere; in the Si-ash model, the NS surface composition is made up of 68% Fe-group elements, 11% Si, and 10% S, which is expected if a significant fraction of the mass was accreted by material falling back after the core collapse. More observations are planned for the near future to obtain the spectral energy distribution in the optical. ESO has allocated for us one dark night in July 1998 for more observations of this NS with the NTT-SUSI2 (PI Neuhäuser), where we plan to measure the fluxes in B and R, and to obtain a new detection in V for measuring the proper motion.

Observations with FORS1 at the VLT UT1 can provide an optical spectrum. Measuring its parallax should be feasible on a time-scale of up to a few years, since the object is located foreground to the CrA dark cloud, i.e. at $<$ 130 pc. Together with its X-ray flux and emitting area, we can then determine the radius of this NS. Forthcoming X-ray observations with AXAF and XMM can provide us with its surface gravity, so that we can, for the first time, obtain the mass of an isolated NS. This will constrain the equation of state of degenerate matter.

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