

September: Poulain, Olofsson / Bergvall / Ekman, Le Bertre / Epchtein / Nguyen-Q-Rieu, Epchtein / Group of astronomers of São Paulo, Alcaíno / Liller, Wargau / Drechsel / Rahe / Strupat.

50 cm ESO Photometric Telescope

April: Scaltriti / Busso / Cellino, Udalski / Geyer, Zickgraf / Leitherer / Stahl / Gail, Gustafsson / Frisk / Edvardsson, Leandersson.

May: Leandersson, Carrasco / Loyola, Lodén, K. / Kennedahl, Mauder.

June: Mauder, Westerlund / Thé.

July: Westerlund / Thé, Carrasco / Loyola, Häfner.

August: Häfner, Di Martino / Zappala / Farinella / Paolicchi / Cacciatori / De Sanctis / Knezevic / Debehogne / Ferreri, Wolf / Appenzeller / Klare / Leitherer / Stahl / Zanella / Zickgraf, Carrasco / Loyola.

September: Carrasco / Loyola, Debehogne / Zappala / De Sanctis.

GPO 40 cm Astrograph

April: Burnage / Fehrenbach / Duflot, Ferreri / Zappala / Di Martino / De Sanctis / Cacciatori / Debehogne / Lagerkvist.

May: Ferreri / Zappala / Di Martino / De Sanctis / Cacciatori / Debehogne / Lagerkvist, Dommanget / Léonis.

June: Dommanget / Léonis.

September: Debehogne / Machado / Caldeira / Netto / Vieira / Mourao / Tavares / Nunes / Zappala / Di Sanctis / Lagerkvist / Protitch-Benishkek / Bezerra.

1.5 m Danish Telescope

April: Veillet / Dourneau / Mignard / Ferraz-Mello, Liller / Alcaíno, Cristiani / Barbieri / Danziger / Romano, Pedersen / v. Paradijs / Lewin, Kunth / Viallefond / Vigroux.

May: Kunth / Viallefond / Vigroux, Pedersen / v. Paradijs / Lewin, Larsson / Dravins.

June: Ardeberg / Lindgren / Maurice / Prévot, Benz / Mayor / Bouvier / Foing / Gondoin, Mayor / Burki, Mayor / Merrilliod, Andersen / Nordström / Olsen.

July: Andersen / Nordström / Olsen, Melnick / Danziger / Terlevich, Castellani / Caloi / Danziger / Gilmozzi, Miley / Lub / de Jong.

August: Miley / Lub / de Jong, Durret / Bergeron, White / Mason / Parmar, Testor / Lortet / Heydari-Melayeri / Niemela, Quintana.

September: Quintana.

50 cm Danish Telescope

May: Schneider / Maitzen, Weiss / Schneider / Knölker, Vander Linden.

June: Vander Linden.

90 cm Dutch Telescope

April: Grenon / Lub.

May: Grenon / Lub, Pakull / Beuermann / Weißsieker / Klose.

June: de Jager, de Zeeuw / Lub / Blaauw, Foing / Bonnet / Linsky / Walter.

July: Foing / Bonnet / Linsky / Walter, Tanzi / Pakull / Tarengi.

August: v. Paradijs / Tjemkes / Bath / Charles.

September: v. Paradijs / Tjemkes / Bath / Charles, v. Paradijs / Tjemkes / Bath / Zuiderwijk, v. Paradijs / Damen.

61 cm Bochum Telescope

May: Lodén, L. O. / Engberg, Wendker / Heske, Vogt.

June: Vogt, Maitzen / Catalano / Gerbaldi / Schneider, Kohoutek / Pauls.

July: Kohoutek / Pauls, Sterken group.

August: Sterken group.

September: Sterken group.

Magnesium Isotopes in Halo Stars of Various Metallicities

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Introduction

Population II stars are very old objects, and their relative abundances can give clues on the chemical enrichment at early times. The elemental composition of stars depends on the initial mass function of the progenitor stars which enrich the gas from which they form. Some element ratios in the oldest stars are especially sensitive to the mass of the preceding stars, the so-called population III or population O, first generation of zero-metal stars, today disappeared.

Important ratios are, for example, the oxygen-to-iron, nitrogen-to-iron, magnesium isotope ratios, as well as sodium and aluminium-to-magnesium ratios. In halo stars, oxygen-to-iron ratios above solar seem to point to a first generation of massive ($M > 10 M_{\odot}$) stars. Nitrogen-to-iron ratios in these stars indicate the primary nature of nitrogen at early times, and

this can be explained by a first generation of intermediate or high mass stars.

Calculations are available for the production of magnesium isotopes in intermediate mass stars ($2 < M/M_{\odot} < 8$) and in ordinarily massive stars ($M > 10 M_{\odot}$). The main controversy is whether they are formed through explosive or hydrostatic carbon burning. In the explosive case, the isotopic ^{25}Mg abundance should be proportional to that of ^{24}Mg , whereas ^{26}Mg forms from ^{25}Mg ; in this case, one expects a strong deficiency of $^{25,26}\text{Mg}$ in metal-deficient stars. On the other hand, if their production occurs in hydrostatic conditions, ^{24}Mg is formed during hydrostatic carbon burning, whereas during hydrostatic helium burning one has the reaction $^{22}\text{Ne} (\alpha, n) ^{25}\text{Mg}$ followed by conversion of some ^{25}Mg into ^{26}Mg by neutron capture. In this scenario, a small overdeficiency of $^{25,26}\text{Mg}$ is expected.

Observations of Magnesium Isotopes

In order to determine the ratios $^{24}\text{Mg}/^{25}\text{Mg}/^{26}\text{Mg}$, it is necessary to have very high quality spectra. These can be obtained at the present time using the ESO 1.42 m telescope (CAT) with the Coudé Echelle Spectrometer (CES) and a reticon silicon photodiode array. With a temperature of the reticon maintained at about 150 K, a quantum efficiency around 40 % is achieved, at the wavelengths of 5140 Å, where a spectral resolution $\Delta\lambda = 0.08 \text{ \AA}$ is obtained at a reciprocal dispersion of 2 \AA mm^{-1} . The required signal-to-noise (above 500) and accuracy in the line profile are reached, as illustrated in Fig. 1.

Selection of lines: magnesium isotopic lines are better distinguished through the magnesium hydride. In the system $A^2\Pi-X^2\Sigma$, the MgH (0,0) band forms a head at 5211 Å and the band degrades to the violet. The isotopic shifts vary from ~ 0.0 at the band head to 0.4 \AA around 5000 Å. Besides having a convenient split of lines, it is important to have no blends and relatively strong lines, in order to still observe them in metal-deficient stars. A compromise between these three requirements is met with lines at $\lambda\lambda 5134-5137 \text{ \AA}$, where the isotopic shifts of 0.06 to 0.1 \AA are seen as red asymmetries in each line.

Selection of stars: the MgH lines present a strong dependence on temperature, on gravity, and also on metallicity. In hot stars, most of the MgH molecules dissociate. Consequently, in order to reach metallicities down to $[\text{Fe}/\text{H}] \approx -2.0$ (where $[X] = \log X_{\star}/X_{\odot}$), we have selected cold unevolved halo stars from the catalogue by Carney (1980).

Method for the Determination of Isotopic Abundances

The spectrum synthesis technique is employed to estimate the magnesium isotope abundances. The MgH line profiles are computed, for each star, with the solar isotopic proportions: $^{24}\text{Mg} : ^{25}\text{Mg} : ^{26}\text{Mg} = 79 : 10 : 11$ and the extreme cases $100 : 0 : 0$, $60 : 20 : 20$. The input data required for the synthesis are: molecular data, model stellar atmosphere, elemental abundances and Doppler broadening velocity.

Results

The results obtained so far show a best fit when solar isotopic ratios are assumed. The most metal-deficient star of the sample studied until now does, however, not show a deficiency greater than $[\text{Fe}/\text{H}] = -1.2$. If more metal-deficient

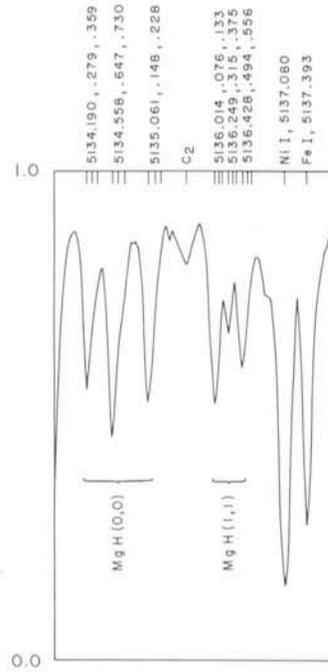


Fig. 1: Spectrum of HD 175329 (ω Pav), star of visual magnitude $V = 5.13$, obtained in 2.5 hours exposure time in October 1982. The region contains unblended MgH lines: groups of 3 wavelengths indicate each the 24,25 and ^{26}MgH isotopic components.

stars show the same result, then we would have an indication for formation of magnesium by hydrostatic carbon burning. In other words, if the present results extend to all metal-deficient stars, then they are not consistent with production of magnesium isotopes through explosive carbon burning, but indicate rather their production under hydrostatic conditions. Such conditions are found in relatively massive stars, according to Arnett and Wefel (1978), and Truran and Iben (1977). The present results are otherwise in agreement with those by Spite and Spite (1980) regarding sodium and aluminium-to-magnesium ratios in halo stars.

References

- Arnett, W. D., Wefel, J. P.: 1978, *Astrophysical Journal* **224**, L139.
- Carney, B.: 1980, "A Catalogue of Field Population II Stars", unpublished.
- Spite, M., Spite, F.: 1980, *Astronomy and Astrophysics* **89**, 118.
- Truran, J. W., Iben Jr, I.: 1977, *Astrophysical Journal* **216**, 797.

The Ultraviolet Absorption Spectrum of NGC 4151

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NGC 4151 is one of the first Seyfert galaxies to have been discovered. Indeed it appears in the original list of 12 galaxies published by Seyfert (1) in 1943. It is certainly the most extensively observed of all Seyfert 1 galaxies. As a reminder, Seyfert 1 galaxies are characterized by the presence of an active, non-thermal nucleus, conspicuous both in X-ray and in the optical, and broad permitted emission lines. These nuclei are believed by many to be low luminosity quasars.

NGC 4151 is an Sab galaxy with a galactocentric radial velocity of 978 km/s, corresponding to a distance of about 20 Mpc.

A striking feature of the optical spectrum of NGC 4151 is the presence of non-stellar absorption features (Balmer lines, He I

$\lambda 3889$) which are blue-shifted with respect to the emission lines and variable in time. The variations of the equivalent width of these emission lines have been interpreted either as real changes in the amount of absorbing matter, or as due to changes of the nuclear continuum brightness variously diluted by the constant stellar component arising in regions adjacent to the Seyfert nucleus (2).

A number of spectra have been obtained with the International Ultraviolet Explorer (3), a satellite launched on 26 January 1978. They cover the spectral range 1150–3250 Å. A number of absorption features of variable equivalent width have been identified (4). It has been claimed that the equivalent width of at least some of these ultraviolet absorption lines,