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# A Planetary Companion around the Young G6 Dwarf Gliese-Jahreiss 3021

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**Abstract.** We present here a new planetary companion detected with the CORALIE spectrograph mounted on the 1.2-m "Leonard Euler" Swiss Telescope at ESO-La Silla Observatory (Chile). It is the fifth detection of the Geneva Southern Planet Survey (Udry et al. 2000). From our radial-velocity measurements, we infer an orbital period of 133.8 days and a semi-amplitude of 164 ms$^{-1}$. The orbit is eccentric ($e = 0.5$). The inferred minimum mass of the companion is $m_2 \sin i = 3.32$ M$_{\rm Jup}$.

## 1. Gliese-Jahreiss 3021: Basic Properties

Gliese-Jahreiss 3021 (GJ 3021, HD 1237, HIP 1292) is a nearby dwarf (17.62 pc away) in the constellation of Hydrus. The basic stellar properties of GJ 3021 are summarized in Table 1. More details about this star and its planet will be presented in Naef et al. (2000).

Table 1. Basic data about GJ 3021

| Parameter | Value | Reference |
|---|---|---|
| *Spectral Type* | G6V | Hipparcos (ESA 1997) |
| *Parallax* (mas) | 56.76 | Hipparcos (ESA 1997) |
| *Distance* (pc) | 17.62 | - |
| $m_V$ | 6.59 | Hipparcos (ESA 1997) |
| $M_V$ | 5.36 | - |
| $(B-V)$ | 0.749 | Hipparcos (ESA 1997) |
| *Mass* (M$_\odot$) | 0.9 | - |
| $V \sin i$ (kms$^{-1}$) | 5.5 | CORAVEL† |
| $[Fe/H]$ | $\simeq 0.2$ | CORAVEL‡ |
| $\log(R'_{HK})$ | $-4.44$ | Henry et al. 1996 |
| $L_X$ (erg s$^{-1}$) | $103.6 \cdot 10^{27}$ | Hünsch et al 1998 |

† Using CORAVEL cross-correlation dip width and the calibration by Benz & Mayor (1984)
‡ Using CORAVEL cross-correlation dip surface and the calibration by Pont (1997).

Using Flower's bolometric correction calibration (Flower 1996) and Hipparcos data, we can compute the effective temperature and the luminosity of GJ 3021:

$$T_{eff} = 5417 \text{ K}$$
$$\text{L} = 0.66 \text{ L}_{\odot}$$

With the chromospheric activity indicator $\log(R'_{HK})$, we can infer estimations for the rotational period (using the calibration by Noyes et al. 1984) and the stellar age (with the calibration by Donahue 1993):

$$P_{rot} = 10.4 \text{ days}$$
$$\text{age} = 0.6 \text{ Myr}$$

The high value of the activity indicator, the high value of the X-ray luminosity and the rather high value of the rotational velocity suggest that GJ 3021 is a very young star. This interpretation is corroborated by the detection of a strong Lithium feature in the stellar spectrum (see Fig. 1).

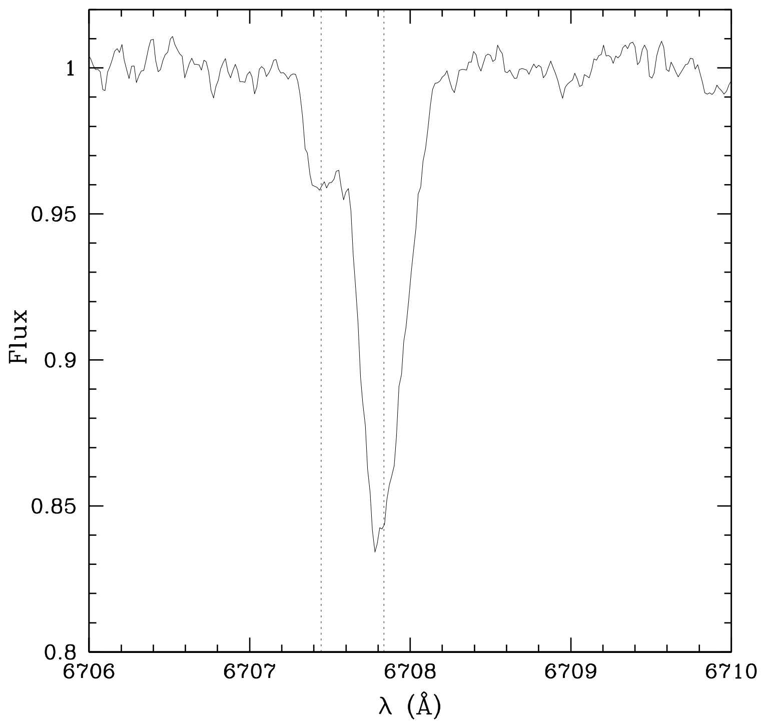


Figure 1. 6707.8 Å Lithium absorption feature of GJ 3021. This spectrum is the result of the addition of 39 CORALIE spectra. The signal-to-noise ratio at the continuum is more than 300. The 6707.4 Å Iron absorption feature is also clearly visible.

## 2. Radial-Velocity Data and Orbital Solution

50 radial-velocity measurements of GJ 3021 were obtained with the CORALIE echelle spectrograph between HJD=51128 and HJD=51564. The mean photon-noise error of these measurements is 8 $\mathrm{ms}^{-1}$. Table 2 shows the results of the Keplerian orbit fitted to the data. Figure 2 shows the phase-folded curve and the velocities as a function of time for GJ 3021.

Table 2. Orbital solution for GJ 3021

| | |
|---|---|
| *Period* (days) | $133.82 \pm 0.20$ |
| $T$ (Julian Date) | $51412.48 \pm 0.62$ |
| *Eccentricity* | $0.505 \pm 0.018$ |
| $\gamma$ *Velocity* ($\mathrm{kms}^{-1}$) | $-5.808 \pm 0.003$ |
| $\omega$ ($^\circ$) | $291 \pm 3$ |
| $K$ ($\mathrm{ms}^{-1}$) | $164 \pm 4$ |
| $a_1$ sini (Gm) | $0.260 \pm 0.007$ |
| $f_1(m)$ ($10^{-8}$ $\mathrm{M}_\odot$) | $3.92 \pm 0.31$ |
| $m_2$ sini ($\mathrm{M_{Jup}}$) | $3.32^{\dagger} \pm 0.1^{\ddagger}$ |
| $N_{meas}$ | 50 |
| $\sigma(O-C)$ ($\mathrm{ms}^{-1}$) | 18.5 |
| *Orbital Separation* (AU) | 0.49 |
| *Equilibrium Temperature* (K) | $\simeq 315$ |

$^\dagger$ Assuming a primary mass $m1 = 0.9\,\mathrm{M}_\odot$

$^\ddagger$ Error on $m1$ not taken into account

## 3. Extrasolar Planets orbiting Active Stars

It is now well known that chromospherically active stars can exhibit intrinsic radial-velocity variations (Saar & Donahue 1997, Santos et al. 2000b). Intrinsic processes correlated with the stellar rotational period such as spots can produce short-term variations. Long-life spots locked on the stellar surface can produce an almost perfectly periodic radial-velocity signal that can mimic the signal induced by a planetary companion as e.g for HD 166435 (Queloz et al. 2000).

In the case of GJ 3021, the obtained period is much longer than the expected rotational period for such a high activity level. The planetary interpretation is thus doubtless. Intrinsic processes are nevertheless probably responsible for the abnormally high scatter observed around the fitted orbit ($\sigma(O-C) = 19$ $\mathrm{ms}^{-1}$ to be compared with the typical CORALIE precision of 7-8 $\mathrm{ms}^{-1}$). It has recently been shown (Saar et al. 1998, Santos et al. 2000b) that the extra radial-velocity scatter was depending on the spectral type of the target. A smaller scatter is expected for active late G dwarfs than for early active G dwarfs. For GJ 3021, the extra scatter is of the order of 15 $\mathrm{ms}^{-1}$. For cooler active stars, the observed

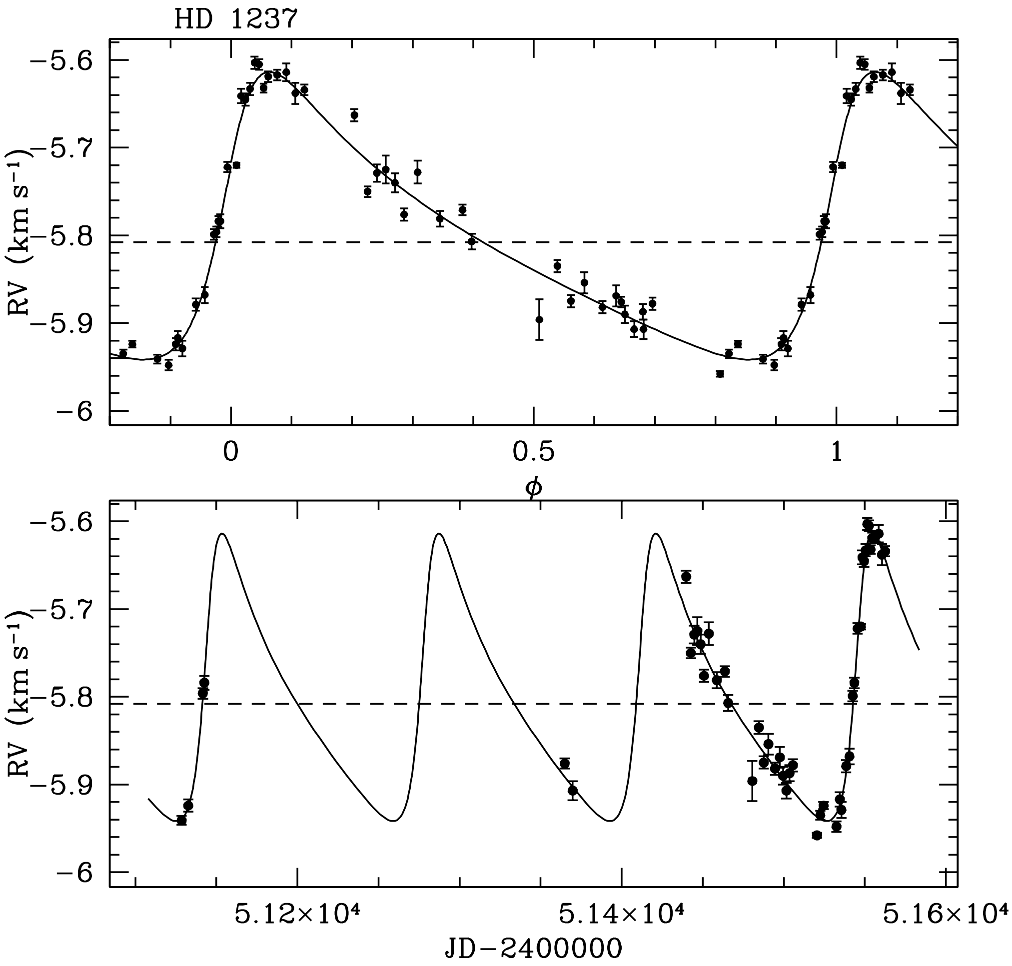


Figure 2. CORALIE radial-velocity data: Phase-folded curve (Top) and velocities versus time (Bottom)

extra scatter is even smaller. For example, HD 130322 and HD 192263 (both stars are active K0 dwarfs with planetary companions) exhibit an extra jitter below 10 ms$^{-1}$ (Udry et al. 2000, Santos et al. 2000a).

Intrinsic processes have very short timescales so it remains possible to detect long-period massive planets orbiting active stars (see for example the planet found around the active G0 dwarf $\iota$ *Hor* (Kürster et al. 2000)). The small observed scatter around late-type active stars makes it possible to detect even short-period planets around them (the planet around HD 130322 has a period of 10.72 days). Active stars remain good candidates for planet searches (at least the coolest ones).

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