A&A manuscript no.
(will be inserted by hand later)

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08 (03.20.4; 04.03.1; 08.05.2; 08.16.5; 08.22.3)

ASTRONOMY AND ASTROPHYSICS

EXPORT: Near-IR observations of Vega-type and PMS stars

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Received; accepted

Abstract. We present near-IR JHK photometric data of a sample of 58 main-sequence, mainly Vega-type, and pre-main sequence stars. The data were taken during four observing runs in the period May 1998 to January 1999 and form part of a coordinated effort with simultaneous optical spectroscopy and photo-polarimetry. The near-IR colors of the MS stars correspond in most cases to photospheric colors, although noticeable reddening is present towards a few objects, and these stars show no brightness variability within the observational errors. On the other hand, the PMS stars show near-IR excesses and variability consistent with previous data.

Key words: Stars: Vega-type stars – PMS stars – Near-IR

1. Introduction

The discovery of far-IR excesses associated with Vega, *β Pic* and some other similar stars was one of the major scientific outcomes of the IRAS mission. These findings indicate the presence of significant amounts of solid material around main-sequence stars other than the Sun (e.g. Backman & Paresce 1993). Coronographic observations revealed that the dust in β Pic is distributed in an edge-on disk (Smith & Terrile 1984). Transient spectroscopic events in the lines of many UV and optical lines have been interpreted as being due to infalling comet-like bodies, while asymmetries in the disk have been attributed to the presence of a planet in the β Pic system (see Lecavelier des Etangs 2000, for a recent review on β Pic). Thus, it seems to be beyond doubt that the young (age $t \sim 10^7$ years, Barrado y Navascués et al. 1999), main-sequence star β Pic harbors a protoplanetary disk in which planets are being formed, and perhaps have already formed. In this respect it should be noted that the G8 V star ρ^1 Cnc, with an age of $t \sim 5 \times 10^9$ yr and a Jupiter-like planet orbiting it, also shows the presence of a Vega-like dust disk in data from ISO (Dominik et al. 1998). On the other side of the stellar evolutionary path, it has been suggested on the basis of various observational data that a population of pre-main sequence stars may be β Pic progenitors (Grady et al. 2000). Thus, an observational framework tracing the path of the formation of planetary systems, from protostellar disks to well developed planets, is growing.

The 1998 international observing time of the Canary Islands Observatories was allocated to the EXPORT collaboration (EXoPlanetary Observational Research Team)

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and a considerable fraction of this time was dedicated to observations of a large sample of main sequence, mainly Vega-type stars, and pre-main sequence stars (Eiroa et al. 2000). The aim of this effort was to study stars at different evolutionary stages to provide some clues regarding protoplanetary disk evolution. The main EXPORT observations consisted of intermediate and high resolution optical spectra supported by simultaneous optical photopolarimetry and near-IR photometry. The stars in this sample were monitored over a range of different timescales from days to months. In this paper we present the near-IR data we collected and a brief description of the general near-IR behavior of the sample. Detailed analysis of these results in combination with the rest of the EXPORT observations will be presented elsewhere.

2. Observations

Near-IR data were obtained at the Teide Observatory (Tenerife, Canary Islands) with the 1.5m Carlos Sánchez Telescope (CST) during four observing runs: 1998 14-17 May, 28-31 July, 23-26 October and 1999 28-31 January. There were a total of 13 useful (some only partially) nights. We used two different instrumental setups throughout the runs. A single channel NIR photometer equipped with an InSb detector was used in May and October; a 15 arcsec beam and a chopper-throw of 30 arcsec were selected for these observations. During the July and January runs CAIN, a 2D NIR camera equiped with a NICMOS 256x256 HgCdTe array, was used. The photometer was operated in standard AC mode, chopping between two adjacent beams, with no further adjustments. The images taken with CAIN were flat fielded and dark current corrected using standard procedures. A minimum of two different frame series were taken for each object, shifting the targets throughout the detector quadrants to remove systematic effects. The averaged series in different quadrants were then subtracted one from another to remove the sky contribution to the measured signal. The time interval between two adjacent series was kept below 2 minutes to avoid background variations of the atmospheric emission. Due to the brightness of some sources (K < 8 mag) we defocused the camera in order to avoid departures from the linear range of the NICMOS array. Errors introduced by the defocusing, together with sky variations, are well below 0.1 mag, as estimated from the sigma-value of the averaged results. Observations with the single channel photometer and CAIN were carried out through standard broad-band JHK filters. Cross-correlations between measurements taken with both instruments of the same objects show negligible systematic deviations and no filter correction has been applied to the results. Data reduction proceeded in a standard way. Magnitude errors estimated from a least-squares fit to the standard star data are $\leq$0.02 mag (1σ rms) in each filter for the data taken with the single-detector photometer. Errors are larger, around 0.05 mag (1σ rms), for the data taken with the camera.

3. Results

The observed sample consists of 58 objects: 40 are PMS stars (HAeBe and T Tauri stars) and 18 MS stars (Vega-type and Lindroos post-T Tauri systems). The stars were observed once per night whenever they were observable from the Canary Islands; in a few cases there are several observations per night. Thus we obtained daily (approx. 24 hours) and 3-monthly (approx. 90 days) monitoring for most of the stars.

Tables 1 and 2 summarize the results of the near-IR observations for the MS stars and the PMS objects respectively. In general, we consider objects variable when different measurements in each filter differ by more than the conservative limit of 5σ, i.e. 0.1 magnitudes in the May 98 and October 98 observing runs. For the July 98 and January 99 runs, we take the value of 0.15 magnitudes, i.e. 3σ, but also taking into account the results of the other two observing periods.

4. MS stars

This group of stars includes double systems in which the secondary has been classified as a post-T Tauri (PTT) star, while the primary is an early type star (Lindroos 1986); in some cases they show far-infrared excesses revealing the presence of cool dust in the circumstellar environment (Ray et al. 1995). Only in one case of the PTT systems, HR 4757, were our near-IR observations carried out for both components of the double; for the rest we observed the brighter component. All these stars are referred to as PTT in Table 1. In addition, we include in this group A-shell stars and other stars which show properties similar to Vega and β Pic, i.e. IRAS excess and/or optical evidence of circumstellar gas (Backman & Paresce 1993; Stencel & Backman 1991, Cheng et al. 1991; Lagrange-Henri et al. 1990). These stars are also referred to as "Vega" in Table 1.

Seven stars in our sample - HR 10, HR 26, HR 419, HR 836, HR 1369, HR 5422, and HR 9043 - have no previous published JHK magnitudes. In the case of λ Boo only the K magnitude has previously been reported; in all other cases, our near-IR magnitudes are similar to those published previously. Table 3 compares our mean near-IR magnitudes with those found in the literature and it is apparent that there are no significant differences. All stars of this group are constant in brightness. The apparent variability of BD +31°643 during the October 98 observations, although it was the best period in terms of photometric quality, needs to be confirmed and we do not discuss it further.

Table 1. Near-IR magnitudes of Vega-type and post-T Tauri stars. JD is +2400000.

Object	Class	Sp.T.	JD	J	H	K
HR 10	Vega	A2IV/V	51110.48854	5.87	5.80	5.77
HR 26	PTT	B9Vn	51023.58819	5.55	5.58	5.60
			51024.57222	5.51	5.57	5.60
			51025.55868	5.56	5.57	5.58
			51026.58455	5.54	5.54	5.56
HR 419	PTT	B9V	51023.63391	6.61	6.61	6.63
			51024.61649	6.53	6.58	6.60
			51025.61209	6.60	6.59	6.60
			51026.63066	6.55	6.55	6.57
49 Cet	Vega	A3V	51023.65208	5.62	5.57	5.56
			51024.63681	5.45	5.50	5.51
			51025.62292	5.50	5.50	5.49
			51026.63553	5.48	5.49	5.47
HR 836	PTT	B6V	51025.66354	5.28	5.32	5.33
			51026.66597	5.30	5.33	5.36
BD $+31°643$	Vega	B5	51110.60174	6.95	6.75	6.64
			51111.52153	6.83	6.62	6.50
			51112.46632	7.37	7.15	7.03
			51113.47604	6.79	6.58	6.49
			51208.38715	6.78	6.65	6.62
			51208.41991	6.77	6.61	6.56
			51209.38929	6.96	6.65	6.56
			51209.46676	6.91	6.64	6.57
			51210.45139	6.99	6.71	
			51210.51713	6.91	6.74	
HD 23362	Vega	K2	51023.69618	5.02	4.16	3.91
			51024.69340	4.91	4.02	3.78
			51025.69375	4.81	4.00	3.81
			51026.68715	4.75	4.00	3.82
HD 23680	Vega	G5	51023.67743	6.19	5.49	5.23
			51024.68090	6.03	5.37	5.20
			51025.66944	5.95	5.34	5.19
			51026.67292	5.94	5.36	5.23
			51208.39444	5.97	5.29	5.30
			51209.39282	6.06	5.43	5.33
			51210.45556	6.00	5.40	
HR 1369	PTT	B9V	51110.66632	5.41	5.43	5.43
HD 34700	Vega	G0V	51110.74375	7.96	7.63	7.40
			51111.65035	7.96	7.63	7.40
			51112.61493	8.01	7.69	7.45
			51113.61215	7.97	7.63	7.39
			51208.46366	8.05	7.67	7.45
			51209.44176	8.05	7.65	7.48
			51210.47928	8.03	7.66	
HR 2174	Vega	A3Vn	51111.75451	5.43	5.39	5.37
			51112.73368	5.45	5.42	5.41
			51113.74236	5.43	5.37	5.35
HR 4757	PTT	B9.5V	50949.41945	2.97	3.00	3.11
			50950.40035	3.01	3.03	3.03
HR 4757B		K2V	50949.43223	6.76	6.33	6.25
			50950.40764	6.78	6.35	6.25
λ Boo	Vega	A0Vpsh	50949.45868	3.96	3.92	3.90
			50950.43715	3.95	3.93	3.91
HR 5422	PTT	A0V	50949.46597	6.09	6.11	6.12
			50950.44445	6.08	6.12	6.13
HD 142764	Vega	K5	50949.52153	6.36	5.55	5.35
			50950.48715	6.34	5.55	5.34
HD 218396	Vega	A5V	51025.54253	5.37	5.25	5.23
			51026.57118	5.33	5.22	5.22
HR 9043	Vega	A5V	51110.47639	5.85	5.76	5.72

Table 2. Near-IR magnitudes of PMS stars. JD is +2400000.

Object	Class	Sp.T.	JD	J	H	K	Variability
VX Cas	HAeBe	A0/3e	51023.61042	10.71	9.35	8.31	Y
			51024.58796	10.66	9.21	8.07	
			51025.56944	10.45	9.22	8.23	
			51026.61493	10.30	9.10	8.16	
			51110.54120	10.08	9.12	8.15	
			51111.42431	10.05	9.12	8.16	
			51112.41597	10.13	9.17	8.21	
			51113.43250	10.00	9.09	8.14	
LkHα 200	TTS	K	51110.56759		10.12	9.60	
			51111.44323	10.95	10.18	9.65	
			51112.43212	10.94	10.15	9.64	
			51113.44531	11.01	10.23	9.72	
V594 Cas	HAeBe	B8:e	51025.57708	8.38	7.14	6.12	
			51026.62292	8.30	7.15	6.10	
LkHα 262	TTS	K?	51023.66903	10.86	10.02	9.67	Y
			51110.58495	10.67	9.87	9.51	
			51111.46146	10.62	9.86	9.50	
			51112.45313	10.87	10.13	9.85	
			51113.46417	11.18	10.48	10.02	
XY Per	HAeBE	B6/A5e	51110.61146	7.64	6.85	5.99	
			51111.52951	7.64	6.86	6.00	
			51112.50903	7.59	6.82	5.97	
			51113.51701	7.59	6.83	5.99	
			51208.39861	7.84	7.08	6.23	
			51209.39560	7.91	7.05	6.18	
			51210.45903	7.87	7.02		
CW Tau	CTT	K3	51110.62049	8.94	7.71	6.63	Y
			51111.54653	9.35	7.96	6.80	
			51112.51632	9.37	7.95	6.77	
			51113.52326	9.30	7.93	6.73	
			51208.40139	9.53	8.22	7.06	
			51209.39988	9.75	8.27	7.10	
			51209.47025	9.73	8.33	7.13	
			51210.46337	9.73	8.35		
RY Tau	ETT	G2/K1IV/V	51110.62813	7.23	6.22	5.34	Y
			51111.56042	7.25	6.24	5.43	
			51112.52326	7.31	6.28	5.46	
			51113.53056	7.44	6.40	5.55	
			51208.40799	7.55	6.44	5.53	
			51209.40370	7.41	6.32	5.42	
			51210.46632	7.27	6.29		
DK Tau	CTT	K7	51110.67743	8.93	7.88	7.06	Y
			51111.56910	9.09	8.02	7.18	
			51112.52951	8.69	7.65	6.87	
			51113.53646	8.86	7.86	7.07	
			51208.41684	8.99	7.97	7.23	
			51209.40706	8.94	7.93	7.17	
			51210.46910	8.76	7.86		
DR Tau	CTT	K4V:e	51110.68576	8.92	7.83	6.88	Y
			51111.57813	9.19	8.08	7.12	
			51112.53854	8.91	7.81	6.84	
			51113.54271	8.79	7.69	6.76	
			51208.42917	9.01	7.84	6.89	
			51209.41007	8.92	7.79	6.97	
			51210.47269	8.84	7.86		
HD 31684	HAeBe	A3ep+sh	51110.69375	6.95	6.40	5.66	
			51111.58924	6.97	6.40	5.67	
			51112.54583	6.99	6.43	5.69	
			51113.55104	6.98	6.41	5.67	

Table 2. Cont.

Object	Class	Sp.T.	JD	J	H	K	Variability
UX Ori	HAeBe	A2/3eIII	51110.70278	8.76	8.08	7.26	Y
			51111.63438	8.82	8.12	7.30	
			51112.55313	8.92	8.19	7.37	
			51113.55799	8.91	8.20	7.37	
			51208.45417	8.95	8.41	7.56	
			51209.41267	8.92	8.31	7.62	
			51210.44792	8.96	8.34		
			51210.47459	8.88	8.39		
			51210.54010	8.90	8.34		
HD 34282	HAeBe	A2Ve+sh	51110.73646	9.13	8.41	7.61	
			51111.64063	9.06	8.38	7.60	
			51112.66007	9.16	8.43	7.65	
			51113.66493	9.08	8.37	7.60	
			51208.45922	9.21	8.53	7.74	
			51209.43918	9.13	8.55	7.93	
			51210.47685	9.12	8.51		
V346 Ori	HAeBe	F1:III:e	51110.75208	9.42	8.90	8.31	
			51111.65625	9.38	8.90	8.29	
			51112.62222	9.41	8.93	8.30	
			51113.61910	9.42	8.89	8.27	
			51208.46725	9.57	9.07	8.51	
			51209.44453	9.50	9.03	8.55	
			51210.48206	9.48	9.06		
CO Ori	ETT	F9/GVe	51110.76007	8.36	7.45	6.62	Y
			51111.66250	8.41	7.51	6.64	
			51112.62917	8.64	7.65	6.75	
			51113.62570	8.65	7.65	6.74	
			51208.47008	8.93	7.94	6.97	
			51208.51285	9.01	7.89	6.91	
			51209.44722	8.89	7.84	6.95	
			51209.50503	8.87	7.81	6.91	
			51210.50613	8.68	7.77		
			51210.54742	8.67	7.72		
HK Ori	HAeBe	B8/A4ep	51110.76806	9.32	8.23	7.23	
			51111.66771	9.32	8.24	7.23	
			51112.63507	9.34	8.26	7.25	
			51113.63542	9.31	8.20	7.21	
			51208.47361	9.36	8.27	7.18	
			51209.45903	9.22	8.18	7.26	
			51210.51146	9.06	8.11		
RY Ori	ETT	F6/Gep	51111.67743	9.51	8.90	8.29	Y
			51112.64236	9.95	9.14	8.46	
			51113.64722	10.61	9.80	9.09	
			51208.47685	9.87	9.12	8.46	
			51208.51632	9.92	9.12	8.39	
			51209.49369	9.80	9.05	8.47	
			51209.52477	9.80	9.06	8.44	
			51210.53449	9.94	9.18		
CQ Tau	ETT	F2:e	51111.68611	7.89	7.14	6.30	Y
			51112.65035	8.04	7.28	6.42	
			51113.65486	7.76	7.09	6.31	
			51208.48021	8.27	7.27	6.29	
			51208.51933	8.29	7.29	6.23	
			51209.49722	8.08	7.13	6.30	
			51209.52729	8.08	7.15	6.29	
			51210.53733	7.89	7.12		
			51210.58252	7.83	7.08		

Table 2. Cont.

Object	Class	Sp.T.	JD	J	H	K	Variability
NV Ori	HAeBe	F0/8IVe	51111.69479	8.70	8.18	7.61	
			51112.65949	8.69	8.18	7.61	
			51113.67917	8.71	8.22	7.64	
			51208.48403	8.90	8.30	7.66	
			51209.50017	8.81	8.29	7.73	
			51210.54184	8.74	8.19		
T Ori	HAeBe	A3/4e	51111.20104	8.37	7.33	6.34	Y
			51112.66702	8.52	7.43	6.40	
			51113.68958	8.39	7.32	6.30	
			51208.48669	8.58	7.43	6.38	
			51209.50243	8.35	7.43	6.45	
			51210.54473	8.31	7.38		
BF Ori	HAeBe	A6e	51111.70790	8.92	8.45	7.81	Y
			51112.71354	8.98	8.54	7.91	
			51113.72153	9.03	8.52	7.85	
			51208.52303	9.07	8.42	7.69	
			51209.50764	9.00	8.48	7.76	
RR Tau	ETT	F:e	51111.71597	9.15	8.12	7.08	
			51112.72014	9.24	8.11	7.03	
			51113.72847	9.05	8.03	7.00	
			51208.52697	9.12	8.03	7.16	
			51209.51366	8.99	7.97	7.07	
			51210.57940	8.88	8.00		
V350 Ori	HAeBe	A5e	51111.72431	10.04	9.23	8.38	Y
			51112.72674	10.01	9.17	8.32	
			51113.73576	9.88	9.13	8.28	
			51208.53171	10.19	9.15	8.08	
			51209.51736	10.23	9.29	8.41	
VY Mon	HAeBe	B9/A0e	51111.76424	8.51	6.94	5.51	Y
			51112.74201	8.35	6.77	5.34	
			51113.74861	8.32	6.77	5.35	
			51208.53750	8.74	7.04	5.47	
HD 141569	HAeBe/ZAMS	A0Ve	50949.51285	6.76	6.65	6.59	
			50950.47847	6.75	6.66	6.59	
			51023.41319	6.62	6.51	6.49	
			51024.41100	6.66	6.58	6.51	
			51025.40590	6.72	6.58	6.51	
			51026.40463	6.71	6.56	6.51	
HD 142666	HAeBe/ZAMS	A7Ve	50949.55694	7.30	6.74	6.09	
			50950.52326	7.30	6.73	6.06	
			51023.42083	7.29	6.80	6.23	
			51024.41840	7.38	6.78	6.10	
			51025.41181	7.39	6.80	6.16	
			51026.40868	7.37	6.78	6.12	
HD 144432	HAeBe	A7Ve	50949.57153	7.07	6.53	5.93	
			51023.42813	7.07	6.52	5.94	
			51024.43403	7.20	6.62	5.90	
			51025.41667	7.07	6.48	5.87	
			51026.41250	7.12	6.51	5.89	
HD 150193	HAeBe	A2Ve	50949.58403	6.89	6.14	5.33	
			51026.41858	7.00	6.25	5.50	
HD 158352	HAeBe/ZAMS	A7/8Vsh	50949.59340	4.92	4.82	4.80	
KK Oph	HAeBe	A5Ve	59049.62708	8.77	7.19	5.78	Y
			51023.43819	9.22	7.47	5.98	
			51024.45208	9.58	7.64	6.13	
			51025.42500	9.00	7.26	5.86	
			51026.48264	8.86	7.23	5.82	
HD 163296	HAeBe/ZAMS	A3Vepsh	50949.64861	6.17	5.49	4.71	Y
			51023.45521	6.36	5.67	4.87	
			51024.46111	6.49	5.71	4.84	
			51025.43160	6.22	5.54	4.79	
			51026.48877	6.19	5.54	4.76	

Table 2. Cont.

Object	Class	Sp.T.	JD	J	H	K	Variability
MWC 297	HAeBe	O9e	50949.70799	6.12	4.54	3.14	
VV Ser	HAeBe	B1/3e/A2:	50949.65695	8.70	7.47	6.34	
			51023.46354	8.91	7.74	6.50	
			51024.50799	9.06	7.64	6.51	
			51025.46649	8.88	7.58	6.50	
			51026.50868	8.83	7.57	6.49	
			51110.35174	8.91	7.64	6.43	
			51111.32535	8.72	7.48	6.31	
			51112.34097	8.82	7.56	6.38	
			51113.35521	8.73	7.49	6.32	
HD 179218	HAeBe/ZAMS	B9/A0IV/Ve	50949.71563	6.99	6.61	5.95	
WW Vul	HAeBe	A0/3e	50949.69444	9.29	8.42	7.50	Y
			51023.49601	9.16	8.28	7.37	
			51024.51354	9.28	8.26	7.25	
			51025.47431	9.20	8.22	7.36	
			51026.51337	9.15	8.19	7.33	
			51110.36736	9.23	8.38	7.46	
			51111.33576	9.24	8.40	7.46	
			51112.34757	9.26	8.37	7.44	
			51113.36354	9.37	8.46	7.50	
PX Vul	HAeBe	F0V:e	51023.50243	9.34	8.63	7.92	
			51024.51823	9.42	8.58	7.85	
			51025.47986	9.33	8.58	7.91	
			51026.51875	9.32	8.54	7.98	
			51110.37674	9.36	8.59	7.85	
			51111.34340	9.31	8.52	7.77	
			51112.35382	9.33	8.55	7.81	
			51113.36979	9.30	8.51	7.78	
HD 190073	HAeBe	B9/A0Vp+sh	51023.51788	7.21	6.67	5.94	
			51024.52465	7.22	6.63	5.85	
			51025.50000	7.23	6.66	5.93	
			51026.53316	7.17	6.60	5.89	
AS 442	HAeBe	B8e	51023.53507	8.80	7.72	6.66	
			51024.54016	8.80	7.59	6.46	
			51025.51354	8.74	7.63	6.63	
			51026.55191	8.68	7.55	6.58	
HD 199143	HAe/ZAMS	F8V	51023.55208	6.18	5.89	5.83	
			51024.55833	6.12	5.86	5.79	
			51025.52934	6.17	5.90	5.81	
			51026.55764	6.15	5.88	5.80	
			51110.42188	6.21	5.90	5.81	
			51111.36354	6.17	5.86	5.78	
HD 235495	HAeBe	A0e	51025.53785	8.46	7.66	6.89	
			51026.56528	8.43	7.62	6.87	
BM And	CTT	K5V	51023.58090	9.91	9.12	8.48	Y
			51024.56597	9.90	9.02	8.32	
			51025.55162	10.04	9.06	8.49	
			51026.57743	9.97	9.20	8.48	
			51110.46146	9.75	8.99	8.38	
			51111.37396	9.86	9.09	8.44	
			51112.37535	9.90	9.07	8.40	
			51113.39201	10.13	9.19	8.51	

Table 3. Comparison of the EXPORT magnitudes of the MS stars with other published results

Object	J	H	K	Reference
49 Cet	5.51	5.51	5.51	1
	5.54	5.51	5.51	2
BD +31°643	6.93	6.71	6.61	1
		6.69	6.47	3
HD 23362	4.87	4.04	3.83	1
	4.89	4.05	3.85	2
HD 23680	6.02	5.38	5.24	1
	6.01	5.37	5.24	2
HD 34700	8.00	7.65	7.43	1
	7.93	7.71	7.67	4
HR 2174	5.44	5.39	5.37	1
		5.38	5.35	5
			5.44	6
HR 4757	2.99	3.01	3.07	1
	3.06	3.08	3.05	7
	3.01	3.03	3.03	8
	3.04	3.08	3.07	9
HR 4757B	6.77	6.34	6.25	1
	6.81	6.38	6.27	7
λ Boo	3.95	3.92	3.90	1
			3.73	10
HD 142764	6.35	5.55	5.34	1
	6.41	5.58	5.35	2
HD 218396	5.35	5.23	5.22	1
	5.46	5.30	5.28	2

(1) This work; (2) Sylvester et al. 1996; (3) Strom et al. 1974; (4) Coulson et al. 1998; (5) Allen 1973; (6) Fajardo-Acosta et al. 1998; (7) Glass 1974; (8) Lindroos 1983; (9) Bouchet et al. 1991; (10) McAlary & McLaren 1980

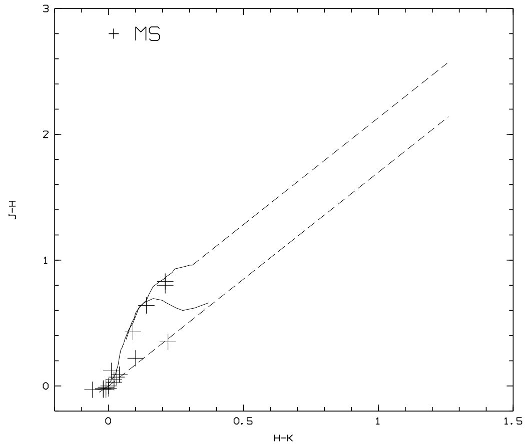

Fig. 1. Two Color diagram of EXPORT PTT and Vega-type stars

Fig. 1 presents the mean observed near-IR colors in a two color (J-H,H-K) diagram of the 18 Vega-type and PTT stars in our sample. Of these, 13 stars have observed colors close to the intrinsic colors of their respective spectral types without any need for correcteions due to interstellar or circumstellar extinction. Thus, the near-IR colors do not show any sign of the presence of hot circumstellar dust. These stars are also unpolarized in the optical (Oudmaijer et al. 2001). The rest behaves as follows. **HD 142764:** The observed colors are compatible with a K5 V spectral type suffering considerable reddening. Assuming a normal interstellar extinction law (e.g. Rieke & Lebofsky 1985) we estimate an optical extinction of A_v = 1.8, from the $J-H$ color. This is consistent with the extinction value deduced from optical photometry. The star also shows considerable polarization at these wavelengths (Oudmaijer et al. 2001). **BD +31°643** : This star's colors are compatible with a B5V star suffering a total extinction of A_v = 2.6 magnitudes (from the $J-H$ color), in good agreement with the estimate of A_v = 2.8 based on optical measurements (Snow et al. 1994, Oudmaijer et al. 2001). The star is polarized in the optical (Andersson & Wannier 1997, Oudmaijer et al. 2001); BD +31°643 has a dust disk which appears similar to that of β Pic (Kalas & Jewitt 1997). **HD 23362**: Its colors are compatible with a K2 star suffering an extinction of 3 mag (from the $J-H$ color), close to the reddening estimate of Sylvester et al. (1996); the star is polarized (Oudmaijer et al. 2001). Based on the optical spectrum, Dunkin et al. (1997) suggested that HD 23362 is not a young main-sequence star. **HD 23680**: The $J-H$ color indicates an extinction of A_v = 2.5 mag, which is close to the extinction estimate from the $B-V$ color; the star is polarized in the optical (Oudmaijer et al. 2001). **HD 34700**: The $J-H$ color is compatible with a G0V star with negligible extinction, in agreement with the optical photometry (Oudmaijer et al. 2001). However, the $H-K$ color seems to indicate a $H-K$ excess. This behavior of practically photospheric $J-H$ color but $H-K$ excess is also present in 51 Oph (Waters et al. 1988). The $H-K$ excess seen in some Vega-type stars is probably due to non-photospheric flux contributing to the K magnitude (Sylvester et al. 1996). HD 34700 also shows a low level of optical polarization (Oudmaijer et al. 2001).

5. PMS stars

5.1. Color-color diagram

Fig. 2 shows the mean observed near-IR colors in a J-H,H-K diagram. 35 out of the 40 PMS objects are clearly located to the right of the reddening line corresponding to an A0V star and show, therefore, a near-IR excess. Of the remaining 5 stars LKHα 200 and LKHα 262 seem to have small near-IR excesses based on their late spectral types, K1 and M0 respectively (Cohen & Kuhi 1979). To our knowledge this paper presents the first near-IR measurements of HD 158352 and HD 199143. Both stars have colors corresponding to a MS star of the same spectral

Table 4. Observed source variations

Object	Sp. T.	$\overline{J}$	δJ	$\overline{H}$	δH	$\overline{K}$	δK
VX Cas	A0	10.30	0.71	9.17	0.26	8.18	0.24
LkHα 262	K?	10.84	0.56	10.07	0.62	9.71	0.52
XY Per	B6	7.73	0.32	6.93	0.26	6.06	0.26
CW Tau	K3	9.46	0.81	8.09	0.64	6.89	0.50
RY Tau	G2/K1	7.35	0.32	6.31	0.22	5.46	0.21
DK Tau	K7	8.89	0.40	7.88	0.37	7.10	0.36
DR Tau	K4	8.94	0.40	7.84	0.39	6.91	0.36
UX Ori	A2	8.88	0.19	8.24	0.33	7.41	0.36
CO Ori	F9	8.71	0.65	7.72	0.49	6.81	0.35
RY Ori	F6	9.93	1.10	9.17	0.90	8.51	0.80
CQ Tau	F2	8.01	0.53	7.17	0.21	6.31	0.19
T Ori	A3	8.42	0.27	7.39	0.11	6.37	0.11
BF Ori	A6	9.00	0.15	8.48	0.12	7.80	0.22
V350 Ori	A5	10.07	0.35	9.19	0.16	8.37	0.33
VY Mon	B9	8.48	0.42	6.88	0.27	5.42	0.17
KK Oph	A5V	9.09	0.81	7.36	0.45	5.91	0.35
HD 163296	A3V	6.29	0.32	5.59	0.22	4.79	0.16
VV Ser	B3	8.84	0.36	7.57	0.27	6.42	0.27
WW Vul	A0	9.24	0.21	8.33	0.23	7.41	0.25
BM And	K5V	9.98	0.38	9.09	0.21	8.44	0.19

type. The stars are unpolarized and the optical photometry is also consistent with their spectral type (Oudmaijer et al. 2001); it is likely that they have already reached the zero age main sequence. HD 141569 has near-IR colors roughly consistent with its spectral type, though with a small amount of reddening, $A_V \leq 1$ mag (the same is approximately true for the optical colors). Our magnitudes are brighter (0.2-0.3 mag) than previous measurements (Malfait et al. 1998, Sylvester et al 1996) but this is probably due to scattered light from the bright companions in its proximity (Pirzkal, et al. 1997). The star is slightly polarized (Oudmaijer et al. 2001, see also Yudin and Evans, 1998). Interestingly, HD 141569 has a β Pic disk (Augereau et al. 1999).

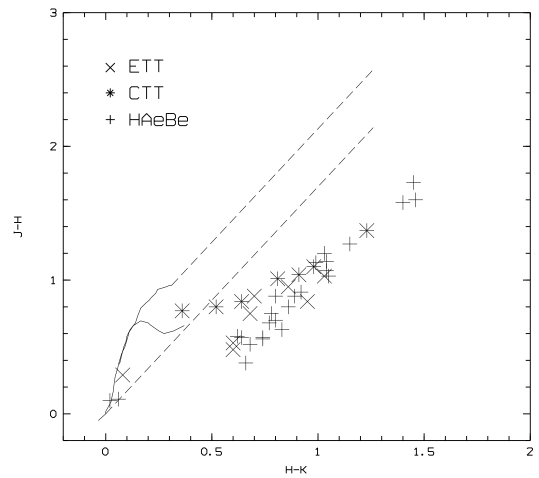

Fig. 2. Two color diagram of EXPORT PMS objects

In Fig. 2 we plot the observed PMS stars in three groups: Classical T Tauri stars (CTTs) - spectral type G2 and later, early-type T Tauri stars (ETTs) -spectral types between F0 and G2, and Herbig Ae and Be stars - spectral types earlier than F0. The position of the stars in the two-color diagram indicates that they occupy a region of the diagram characterized by different amounts of extinction and an excess with respect to the emission of a normal photosphere. The distributions of ETTs and HAeBe in the diagram differ slightly from that of CTTs. In addition, HAeBe and ETTs are located in a band displaced from the reddening band for main sequence stars, but more or less parallel to it. These characteristics are already known from previous work (e.g. Lada & Adams 1992). These authors have shown that standard circumstellar disks can account for the near-IR colors of most T Tauri stars, but those models fail in the case of HAeBe stars. In the latter case, dust disks with central holes are required if self-luminous disks are the cause of the near-IR excess. The models do not provide a unique interpretation of near-IR colors in PMS stars, but they do indicate differences between low- and intermediate-mass young objects.

5.2. *Variability*

Twenty stars in our sample are variable on timescales of days and/or months. In some cases our monitoring is insufficient to establish if the objects have a periodic variability, although it is clear that in several cases the variability is irregular. Irregular variability is often observed in objects similar to those in our sample. Table 4 gives details of the stars in which we detect variability. A comparison with the literature (e. g. the SIMBAD data base) indicates, however, that some of the stars which remained constant during our observations do vary. In general, the variability observed in JHK is roughly consistent with that observed at optical wavelengths (Oudmaijer et al. 2001), in the sense that all objects which are variable in the IR also vary at optical wavelengths.

In $\approx 50\%$ of the sample stars the variability amplitude diminishes with the wavelength; no clear trend appears for the rest. The range of the amplitude is less than 0.4 mag for most of the stars and goes down to our 3σ limit. For 7 stars the variability is larger than 0.5 magnitudes in at least one filter, and in 3 out of the 7 (RY Ori, LkHα 262 and CW Tau) that level of variability is found in all near-IR bands.

The origin of PMS variability is normally attributed to one or more of the the following causes (e.g. Herbst et al 1994, Skrutskie et al. 1996, Herbst & Shevchenko 1999): 1) Cool stellar spots which rotationally modulate the star light, 2) Hot spots caused by a magnetically channeled accretion flow onto the stellar surface, 3) variable obscuration by dust clumps in the circumstellar environment, 4) changes in the temperature profile and structure of the circumstellar dust disk, 5) stellar pulsations (Marconi & Palla, 1998). The first three causes can produce large amplitude variations, up to several magnitudes in the optical, with the amplitude diminishing with increasing wavelength. Variations in the temperature profile of the disk would produce more variability in the near-IR than in the optical since typical disk temperatures (T_D (max) $\sim$ 2000 K) do not give rise to significant emission at visible wavelengths. Stellar pulsations should reveal themselves as periodic small-amplitude variations in the photometric behavior of the PMS stars. Thus, simultaneous observations at near-IR and optical wavelengths provide clues about the origin of the variability and which mechanisms act in the different wavelength ranges. A detailed analysis of the variability, considering the simultaneous near-IR and optical photo-polarimetric behavior, is beyond the scope of this paper and will be presented elsewhere.

6. Conclusions

We have presented the near-IR magnitudes of a sample of 58 main-sequence and pre-main sequence stars taken during the 1998 international time of the Canary Islands Observatories. For some of the stars in the sample these are the first published near-IR data. Although these data were taken in support of simultaneous optical spectroscopy, they reveal interesting aspects in their own right, such as reddening towards some Vega-type stars or the variability of some younger objects.

Acknowledgements. A.Alberdi, C. Eiroa, B. Merín, B. Montesinos, A. Mora, and J. Palacios are supported in part by Spanish grant ESP 98-1339

References

Allen D.A. 1973, MNRAS 161, 145
Anderson B.-G., Wannier P.G. 1997, ApJ 491, 103
Augereau J.C., Lagrange A.M., Mouillet D., Ménard F. 1999, A&A 350, L51
Backman D.E., Paresce F. 1993, in Protostars and Planets III, ed. E.H. Levy, J.I. Lunine (Tucson: University of Arizona Press), p. 1253
Barrado y Navascués D., Stauffer J.R., Song I., Caillault J.-P. 1999, ApJ 520, L 123
Bouchet P., Schmider F.X., Manfroid J. 1991, A&AS 91, 409
Cheng K.-W., Grady C.A., Bruhweiler F. C. 1991, ApJ 366, L87
Cohen M., Kuhi L.V. 1979, ApJS 41, 743
Coulson I.M., Walther D.M., Dent W.R.F. 1998, MNRAS 296, 934
Dominik C., Laureijs R.J., Jourdain de Muizon M., Habing H.J. 1998, A&A 329, L53
Dunkin S.K., Barlow M.J., Ryan S. G., 1997, MNRAS 290, 165
Eiroa, C. et al. (EXPORT) 2000, in Disks, Planetesimals and Planets, ed. F. Garzón, C. Eiroa, D. de Winter, T. Mahoney, ASP Conf. Ser. in press
Fajardo-Acosta S.B., Telesco C.M., Knacke R.F. 1998, AJ 115, 2101
Glass I.S. 1974, MNSSA 33, 53
Grady C. A., Sitko M. L., Russel R. W., et al. 2000, in Protostars and Planets IV, ed. V. Mannings, A.P. Boss and S. S. Russell, (Tucson: University of Arizona Press), in press
Herbst W., Herbst D.K., Grossman E.J., Weinstein, D., 1994, A.J. 108, 1096
Herbst W., Shevchenko V.S. 1999, AJ 118, 1043
Kalas P, Jewitt D. 1997, Nature 386, 52
Lada C.J., Adams F.C. 1992, ApJ 393, 278
Lagrange-Henri A.M., Ferlet R., Vidal-Madjar A., Beust H., Gry C., Lallement R. 1990, A&AS 85, 1089
Lecavelier des Etangs A. 2000, in Disks, Planetesimals and Planets, ed. F. Garzón, C. Eiroa, D. de Winter, T. Mahoney, ASP Conf. Ser. in press
Lindroos K.P. 1983, A&AS 51, 161
Lindroos K.P. 1986, A&A 156, 223
Malfait K., Bogaert E., Waelkens C. 1998, 331, 211
Marconi M., Palla F. 1998, ApJ 507, L141
McAlary C.W., McLaren R.A., 1980, ApJ 240, 853
Oudmaijer R. D. et al. (EXPORT) 2001, A&AS to be submitted
Pirzkal N., Spillar E.J., Dyck H.M. 1997. ApJ 481, 392
Ray T.P., Sargent A.I., Beckwith S.V.M., Koresko C., Kelly P. 1995, ApJ 440, L89
Rieke G.H., Lebofsky M.J. 1985, ApJ 288, 618
Skrutskie M.F., Meyer M.R., Whalen D., Hamilton C. 1996, AJ 112, 2168
Smith B. A., Terrile R.J. 1984, Science 226, 1421
Stencel R.E., Backman D.E. 1991, ApJS 75, 905
Strom S.E., Strom K.A., Carrasco L. 1974, PASP 86, 798
Sylvester R.J., Skinner C.J., Barlow M.J., Mannings V. 1996, MNRAS 279, 915
Waters L.B.F.M., Coté J., Geballe T.R. 1988, A&A 203, 348
Yudin R.V., Evans A. 1998, A&A 131, 401