RevMexAA (Serie de Conferencias), **35**, 146–147 (2009)

INTEGRATED SPECTRAL EVOLUTION OF GALACTIC OPEN CLUSTERS: NEW TEMPLATE SPECTRA FOR STUDIES OF COMPOSITE STELLAR POPULATIONS

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RESUMEN

Usando espectros integrados obtenidos en el CASLEO (Argentina) en el rango 3600–6800 Å, determinamos excesos de color $E(B-V)$ y edades de una muestra de 61 cúmulos abiertos de la Vía Láctea. Comparamos las propiedades de la muestra completa con aquéllas correspondientes a cúmulos abiertos ubicados en sectores similares. Definimos dos nuevos templates de metalicidad solar.

ABSTRACT

Using integrated spectra obtained at CASLEO (Argentina) in the 3600–6800 Å spectral range, we determine $E(B-V)$ colour excesses and ages for 61 open clusters of the Milky Way. We compare the derived properties of the whole sample with those of open clusters located nearly in the same sectors. Two new solar-metallicity templates are defined.

Key Words: methods: observational — open clusters and associations: general — techniques: spectroscopic

1. SPECTROSCOPIC OBSERVATIONS

As part of a program of systematic observation of small angular diameter Galactic open clusters, we present here foreground reddening values and ages for a sample of 61 open clusters located in different regions of the Milky Way (Table 1). Integrated spectra of these clusters were obtained with the Jorge Sahade 2.15 m telescope at Complejo Astronómico El Leoncito (CASLEO, San Juan, Argentina), using the REOSC spectrograph (simple dispersion mode) and a CCD Tektronix chip of 1024×1024 pixels. We used a grating of 300 grooves/mm producing an average dispersion of $\sim$ 3.46 Å/pixel. The slit width was 4.2″, providing a resolution (FWHM) of $\sim$ 14 Å.

2. ANALYSIS OF THE CLUSTER SPECTRA

A first reddening independent age estimate was obtained from the equivalent widths of the Balmer lines. We then selected an appropriate set of template spectra from the libraries of Piatti et al. (2002) and Ahumada et al. (2007a) according to the age provided by the Balmer lines and varied reddening and template to get the best match of continuum and lines of the observed spectrum to that of the template that most resembles it. The derived reddening values are listed in Table 1, together with the ages finally adopted for the clusters. The uncertainties in the $E(B-V)$ determinations vary from 0.01 to 0.10 magnitudes. We refer the reader to the papers by Ahumada et al. (2006) and Ahumada et al. (2007a,b, and references therein) for details about individual clusters.

3. COMPARISON WITH OTHER CLUSTERS IN THE SAME SECTOR

The Galactic open clusters studied here are located within two 90° sectors centered at $l = 257°$ and $l = 347°$, respectively. We compare their properties with those of well-studied clusters taken from the WEBDA Open Cluster Database (Mermilliod & Pauzen 2003) located in the same sectors. The reddening values of our cluster sample appear to have distributions typical of those of the open clusters in the sector. We also found that most of our clusters fall within the most frequent age range for the sectors. The frequency decrease of clusters with increasing age is remarkable in both sectors. The current results confirm those in Ahumada et al. (2007a), in the sense that the inclusion of fainter clusters in this disk sector maintains the age histogram distribution, which represents the formation/dissolution histories of open clusters as seen from the solar locus in the Galaxy. Unless major star forming events took place in the Galactic disk in the last 100 Myr or so, the current results support the conclusion that there was an important dissolution rate of star clusters in these two Galactic sectors.

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TABLE 1

CLUSTER PARAMETERS

Cluster	$E(B-V)$	Age	Cluster	$E(B-V)$	Age
Basel 18	0.30	50±10	Hogg 22	0.65	4.5±2.0
Be 75	0.05	3000±1000	Lynga 1	0.38	100±30
Be 77	0.30	3500±500	Lynga 11	0.12	450±50
Be 80	0.80	600±200	Markarjan 38	0.37	10±10
Bochum 2	0.81	5±2	Melotte 105	0.31	200±100
Bochum 12	0.30	45±15	NGC 2311	0.15	300±50
Bochum 14	1.55	3.0±1.0	NGC 2368	0.12	50±10
BH 55	0.20	600±200	NGC 2409	0.25	50±10
BH 58	0.03	400±100	NGC 2587	0.00	1000±300
BH 87	0.10	150±50	NGC 2635	0.05	1500±500
BH 90	0.08	600±300	NGC 5281	0.25	30±5
BH 92	0.07	350±200	NGC 5606	0.31	4.5±2.0
BH 121	0.45	4±2	NGC 6204	0.40	60±10
BH 132	0.60	150±10	NGC 6268	0.43	60±15
BH 151	1.70	3±1	NGC 6604	1.20	3±1
BH 205	0.31	10±5	Pismis 7	0.40	3000±1000
BH 217	0.80	35±10	Pismis 17	0.19	4.5±2.0
Collinder 258	0.09	100±20	Pismis 21	1.50	80±30
Dolidze 34	0.70	600±100	Pismis 20	1.23	5±1
ESO065-SC07	0.35	2500±1000	Pismis 23	1.00	300±200
ESO324-SC15	0.00	1000±300	Pismis 24	1.90	5±3
ESO429-SC13	0.00	100±20	Ruprecht 2	0.10	3500±1000
ESO445-SC74	0.00	2500±1000	Ruprecht 144	0.32	150±50
ESO492-SC2	0.30	7.5±2.5	Ruprecht 159	0.25	2000±1000
Haffner 7	0.10	100±20	Ruprecht 158	0.05	700±400
Hogg 3	0.15	75±25	Ruprecht 164	0.10	800±200
Hogg 9	0.05	300±100	Trumpler 15	0.50	5±3
Hogg 10	0.50	30±10	Trumpler 21	0.20	30±10
Hogg 11	0.24	8±6	Trumpler 27	2.40	3±4
Hogg 12	0.04	85±15	vdB-RN 80	0.38	4.5±2.0
Hogg 15	1.05	4.5±2.0			±

4. NEW OPEN-CLUSTER TEMPLATE SPECTRA

Two new solar-metallicity templates are defined corresponding to the age groups of (4–5) Myr and 30 Myr among those of Piatti et al. (2002), while two others are redefined. This implies a refinement of this spectral library and an improvement of its temporal resolution. For more details, see Ahumada et al. (2007a).

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