COMMISSION 37: STAR CLUSTERS AND ASSOCIATIONS (AMAS STELLAIRES ET ASSOCIATIONS)

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1. Introduction

The last three years have been very productive for cluster research, especially now that observations with CCDs have become so routine. After a section on recent meetings, and one on data catalogues (by J.-C. Mermilliod), subsequent sections of this report go into details on individual topics: associations (P.E. Nissen), open clusters (G.L.H. Harris), globular clusters and cluster systems (R.E. White) and dynamical theory (D.C. Heggie).

The rapid growth in the volume of observational data has meant regrettably that the information has had to be tabulated in an even more compressed form than in earlier Reports. As in previous Reports, three-figure references are to Astronomy and Astrophysics Abstracts, and two-figure references to Physics Abstracts. Most entries cover publications from 1 July 1984 to 30 June 1987, but some exceptions are noted under the individual sections. For abbreviations see §6.

2. Symposia and Colloquia

The highlight of the past triennium was IAU Symposium 126 on *Globular Cluster Systems in Galaxies* (August 25-9, 1986), on which there is a short report in the IAU *Information Bulletin* no.57, p.27. Proceedings were published from two earlier IAU meetings bearing on the work of the Commission: IAU Symposium no.113 on *Dynamics of Star Clusters* (39.012.070) and no.116 on *Luminous Stars and Associations in Galaxies* (41.012.079). Another publication of interest is the proceedings of a meeting on *The Age of Stellar Systems*, held in 1986 (42.012.104).

3. Catalogs of Cluster Data

Several new catalogues or updates of old catalogues have been announced or are available through the data centres in Strasbourg and at NASA:

Mermilliod, J.-C. (38.002.054, CDS 2-104) - Preliminary Catalogue of Photographic UBV photometry for stars

White, R.E. & Philip, A.G.D. (38.002.071) - Catalog of Cluster CM diagrams

Zhao, T., *et.al.* (40.002.081) - Special Issue for Tables of Membership to 42 Open Clusters

Popova, M., & Kraicheva, Z. (40.153.049) - Catalog of eclipsing and spectroscopic binary stars in the region of Open Clusters

Mermilliod, J.-C. (41.002.005, CDS 4-017) - Catalogue of DM, HD(E) and other cross-identifications for stars in Open Clusters

Lyngå, G. (CDS 7-066) - Catalog of Open Cluster Data (4th Edition)

Mermilliod, J.-C. (CDS 2-124) - Catalogue of UBV photometry and MK spectral types in open clusters (3rd edition)

G. Lyngå reports that he has sent to the Strasbourg Data Centre a copy of the fifth version of his Catalogue of Open Cluster Data.

4. Stellar Associations

INTRODUCTION

This part of the report covers the full three-year period January 1984 - December 1986. Papers on associations in general, and on OB, T and R associations are listed in the following four tables. For abbreviations see §6.

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TABLE 1. ASSOCIATIONS IN GENERAL

(37.113.008) var Ap and He-weak stars
(37.115.014) HR-diagram, stf
(37.131.113) IR obs of R ass
(37.144.018) WR stars, cosmic and γ rays
(38.116.007) rot, stf
(38.155.064) stf
(39.112.044) stellar winds
(40.152.011) dynamics, stf
(40.152.013) ages from phot
(40.065.087) evolution of massive stars
(40.131.265) stf in mol clouds
(40.155.047) rv of OB stars
(40.157.135) ass in M31
(41.126.017) birthplaces of pulsars
(41.156.014) age and stf in LMC
(41.157.218) ass in the galaxy NGC4449
(42.122.059) flare stars
(42.157.167) massive stars in M31
(37.113.014) ex law, IR excess
(37.121.029) X-ray, T-Tauri stars
(37.131.255) far-UV ex
(38.065.002) evolution of WR stars
(38.153.012) frequency of WR stars
(38.156.007) ass in LMC
(40.152.005) ass in M31
(40.152.012) frequency of binaries
(40.152.014) HI supershells
(40.131.262) stf, ages
(40.153.047) stellar abund
(40.156.016) ass in SMC
(41.152.010) ass in galaxies
(41.153.039) stellar abund
(41.157.013) ass in the galaxy NGC2403
(42.121.028) multiple stars in T-ass
(42.157.099) phot of ass in M31

TABLE 2. OB ASSOCIATIONS

Ara OB1	Whiteoak, Gardner (41.131.268)	ist NaI
Cam OB1	Wesselius *et al.* (37.112.049)	IR obs, massive stars
Cas OB2	Lozinskaya *et al.* (41.131.112)	ring nebula, shells, etc
Cen OB1	Doom *et al.* (39.152.003)	time-dependent stf
Cep OB2	Gyul'budagyan *et al.* (41.152.001)	dark globules
	Kun (42.113.006)	Hα em stars
	Kun (42.123.019)	var stars
Cep OB3	Massa, Savage (37.131.174)	UV obs of ist ex
CMa OB1	Gaylard, Kemball (38.132.028)	radio obs, HII regions
	Pyatunina, Taraskin (42.131.328)	radio obs, HII distr
Cyg OB1	Philips *et al.* (37.131.015)	high-vel ist gas
Cyg OB2	Giovannelli *et al.* (38.112.020)	IUE spectra
	Giovannelli *et al.* (42.112.149)	mass loss
Gem OB1	Braun, Strom (42.125.012)	IRAS obs, SNR shock
Mon OB1	Ogura, Hasegawa (37.131.188)	Hα em stars, Bok globules
	Rosino *et al.* (38.122.174)	flare stars
	Parsamyan *et al.* (42.122.060)	flare stars
Mon OB2	Leahy (40.142.044)	X-ray em
Ori OB1	Rydgren, Vrba (37.113.038)	IR excess of G stars
	Rössiger (37.122.147)	young var stars
	Mermilliod, Mayor (39.152.008)	rot vel
	Gasparyan (39.113.030)	phot of Hα stars
	Klochkova (40.114.001)	Bp stars
	Gasparyan (41.122.123)	distr of Hα and flare stars
	Brown, Shore (42.114.124)	spphot of λ1400 ist feature
Per OB1	Doom *et al.* (37.152.004)	age
	Garibdzhanyan (38.114.130)	spphot, d, ist ex
	McLachlan, Nandy (40.152.001)	shock-heated gas
	Schild, Berthet (42.152.001)	blue stragglers
Per OB2	Klochkova, Kopylov (40.152.002)	d, age
	Klochkova, Panchuk (42.114.053)	helium abund of B stars
Sco OB1	van Genderen (38.152.007)	phot, T_{eff}, g
	Heske, Wendker (38.153.003)	phot, relation to Tr24
	Heske, Wendker (40.152.008)	phot, sp, relation to Tr24
Sco OB2	Lipovka *et al.* (37.152.006)	radio em
	Cappa de Nicolau, Pöppel (40.131.194)	HI distr

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	Klochkova, Panchuk (42.114.053)	helium abund of B stars
	Cappa de Nicolau, Pöppel (42.131.024)	ist gas distr

TABLE 3. T ASSOCIATIONS

Cyg T4	Satyvoldiev (37.123.003)	var stars
	Satyvoldiev (39.123.004)	var stars
	Satyvoldiev (40.123.019)	var stars
Tau T1	Nurmanova (39.152.002)	phot, memb
Tau T3	Nurmanova (37.123.004)	var stars
	Nurmanova (39.152.002)	phot, memb

TABLE 4. R ASSOCIATIONS

CMa R1	Nakano *et al.* (38.152.009)	radio obs
	Pyatunina (39.152.001)	radio sources, stf
	Pavolva, Rspaev (42.116.114)	pol
Mon R1	Ogura (37.152.001)	Hα em stars
	Pyatunina (30.152.001)	radio sources, stf
	Pavlova, Rspaev (42.116.114)	pol
Mon R2	Pyatunina (39.152.001)	radio sources, stf
Per R1	Pavlova, Rspaev (42.116.114)	pol

5. Open Clusters

INTRODUCTION

Some papers have discussed a large number of open clusters, general properties of open clusters, overall interpretations of large data samples or models of cluster properties. Those papers are referred to below in a separate tabulation. Extragalactic cluster observations have been excluded, primarily due to the length of this report. However, given the increasing interest in this area, some means of handling such data in future will need to be decided.

Papers and projects which refer to individual open clusters are listed first, where the clusters are ordered according to IAU number. For abbreviations see §6.

CLUSTER-BY-CLUSTER LITERATURE CITATIONS

C0017-302 (Bl 1)
(40.153.005) BV pg phot; E; d; ms gaps.

C0027+599 (NGC 129)
(38.153.001) DDO, uvby, VRI phot; memb.
(39.115.022) sp cl; abs mag.
(41.113.019) Vilnius phot; bright st; RG.

C0039+850 (NGC 188)
(38.153.028) W UMa st; bin; age.
(40.065.053) th isochrones; age.
(40.153.021) W UMa systems.
(40.153.034) sp; ms turnoff st; abund spread.
(41.153.007) R phot; faint st.
(39.116.038) FK Comae-like st.
(39.153.056) age.
(40.117.020) W UMa st; origin.
Kaluzny and Shara (STSI) phot; short-per var.
(42.153.016) Washington phot; RG; abund; CN.
Lee & van Altena (Yale, in press) pm; astrom calibration field.

C0040+615 (NGC 225)
(38.153.001) DDO, uvby, VRI phot; memb.

C0049+563 (NGC 281)
(39.153.055) reddening law.

C0115+580 (NGC 457)
(42.153.005) IUE sp; extinction law.
(39.115.022) sp cl; abs mag.

C0126+630 (NGC 559)
(39.153.035) rv; blue stragglers.

C0129+604 (NGC 581)
(39.115.022) sp cl; abs mag.
(40.153.010) semi-automatic phot.
(41.153.025) memb; mass, age distributions.

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C0132+610 (Tr 1)
(41.153.025) memb; mass, age distributions.
C0140+616 (NGC 654)
(38.153.001) DDO, uvby, VRI phot; memb. (41.153.025) memb; mass, age distributions.
C0140+604 (NGC 659)
(38.153.001) DDO, uvby, VRI phot; memb.
C0142+610 (NGC 663)
(40.153.010) semi-automatic phot. (40.115.034) rot; sp types; B st.
C0154+374 (NGC 752)
(38.153.001) DDO, uvby, VRI phot; memb. (41.153.026) positions; V mag.
(42.153.029) sp; Li abund.
Schiller and Milone (Calgary) UBVRI phot; ecl bin;d.
(42.153.016) Washington phot; RG; abund; CN.
C0215+569 (NGC 869, h Per)
(38.153.001) DDO, uvby, VRI phot; memb. (38.153.008) JIIK(LM) phot.
(39.115.022) sp cl; abs mag. (40.115.034) rot; sp types; B st.
(40.118.018) bin.
C0218+568 (NGC 884, χ Per)
(38.153.001) DDO, uvby, VRI phot; memb. (38.153.008) JIIK(LM) phot.
(39.115.022) sp cl; abs mag. (40.115.034) rot; sp types; B st.
(40.118.018) bin. (42.114.158) SG memb; abund.
C0228+612 (IC 1805)
(38.114.087) sp cl. (40.153.019) rv.
(41.153.025) memb; mass, age distributions.
C0233+557 (Tr 2)
(41.113.019) Vilnius phot; bright st; RG.
C0238+613 (NGC 1027)
(39.153.035) rv, blue stragglers
C0238+425 (NGC 1039)
(42.153.010) δa phot; CP2 st.
C0318+484 (Mel 20, α Per)
(38.113.025) ms gap. (39.153.015) sp; pm; memb; rot; evol low mass st.
(42.153.044) sp types; rot vel; pec st. (40.115.034) rot; sp types; B st.
(42.153.019) space vel; d; memb; vel gradient; expansion.
(42.114.053) He abund; Be st.
Stauffer *et al.* (NASA Ames,Lick,Harvard) phot; light curves; rapid rot K st.
(42.116.052) rot vel; rapid rot.; evolution.
Fehrenbach *et al.* (Haute-Provence) rv 258 st; space vel.
C0328+371 (NGC 1342)
(39.153.035) rv, blue stragglers
C0344+239 (Pleiades)
(38.153.004) sp; UBV phot; E. (38.153.009) sp; Ca II em; pec.
(38.153.011) E; pol. (38.153.014) rot;var; bin.
(38.153.010) pm; flare st; sd. (38.153.024) energy distr; Be st;
(38.153.033) th isochrones; age. (38.041.017) astrometry
(38.113.025) ms gap. (39.153.012) E; pol; pre-ms st.
(38/9.253.016) X-ray survey; B, A st. (39.153.028) X-ray survey; LF.
(39.153.047) pm. (40.153.040) turnon point; age; pre-ms.
(42.153.009) VLBUW phot; memb; pre-ms st. (39.116.015) Hα em; periodicity.
(40.114.100) pec st; sp; age. (39.036.132) phot detection of bin
(40.115.034) rot; sp types; B st. (41.114.088) Fe abund.
(41.116.041) X-ray lum; convection. (41.116.057) BVRIJHK phot.
(42.153.022) lower ms st abund; d. (42.153.028) pol; E; molecular cloud.
(42.114.053) He abund; Be st. (42.122.064) flare st.
(42.122.065) flare st. (42.112.133) CaII, MgII em; late ms st.
(42.122.068) UV-Ceti st in clusters. (42.122.073) fast-rotating flare st.
(42.122.100) radio observations of flare st.
van Leeuwen *et al.* (RGO,Leiden)VBLUW phot; light curves; G and K dwarfs
McNamara (New Mexico State) uvby phot; variability; B st; periods.

Stauffer *et al.* (NASA Ames,Lick,Harvard) phot; light curves; rapid rot K st.

C0403+622 (NGC 1502)
(38.153.001) DDO, uvby, VRI phot; memb.
(39.153.035) rv; blue stragglers.

C0411+511 (NGC 1528)
(38.153.001) DDO, uvby, VRI phot; memb.

C0417+501 (NGC 1545)
(38.153.001) DDO, uvby, VRI phot; memb.

C0417+368 (NGC 1548)
(38.153.001) DDO, uvby, VRI phot; memb.

C0424+157 (Hyades)
(38.153.002) rv; memb; d.
(38.153.009) sp; Ca II em; pec.
(38.153.014) rot;var; bin.
(38.153.017) Li abund.
(38.153.018) color anomalies; starspots.
(38.153.019) astrom r anomalies; starspots.
(38.153.018) astrom and kin par.
(38.153.020) search for memb.
(38.113.025) phot; var; CaII em.
(38.116.023) CaII em; rot.
(38.113.025) ms gap.
(38.117.023) IUE sp; bin; model atm.
(39.153.008) memb search; ms; supercluster.
(39.153.009) memb search; RG; supercluster.
(39.153.013) Cousins VRI phot.
(39.153.023) MgII em; mass and age dependence.
(39.153.025) coude sp;abund.
(39.153.039) metallic-line st; ultrashort period Cep
(39.153.049) α Tauri CD, pm, parallax; memb.
(39.153.051) rv; convergent point; bin.
(39.153.053) bin population analysis
(41.153.041) sp vel; memb.
(40.153.029) abund; d
(40.153.036) plages.
(40.153.015) BVRI phot; memb.
(41.153.014) EXOSAT phot; coronal t.
(41.153.015) X-ray var survey.
(41.153.016) Li abund gap.
(41.153.018) Li abund.
(41.153.023) positions.
(41.153.043) Hα, OI phot.
(39.112.109) CaII em; star spots.
(39.120.008) sp orbits; bin.
(40.153.013) sp; F st; Fe abund.
(41.153.035) bright memb
(41.113.036) uvby phot; interpretation.
(41.114.076) sp; abund.
(41.116.041) X-ray lum; convection.
(41.116.052) coronal X-ray em.
(41.119.041) bin analysis.
(41.119.060) sp; phot; bin orbit.
(41.120.001) speckle interferometry bin st.
(42.065.033) star spots; model comparison.
(42.112.133) CaII, MgII em; late ms st.
(42.113.025) by phot; var; dust.
(42.116.064) X-ray em; modeling.
Peterson & Solensky (SUNY) sp; bin; d.
(42.153.016) Washington phot; RG; abund; CN.
(42.116.052) rot vel; rapid rot.; evolution.

C0443+189 (NGC 1647)
(38.153.001) DDO, uvby, VRI phot; memb.
(40.122.011) Cep; light curves; memb

C0447+436 (NGC 1664)
(38.153.001) DDO, uvby, VRI phot; memb.

C0504+369 (NGC 1778)
(41.153.025) memb; mass, age distributions.

C0509+166 (NGC 1817)
(38.111.015) pm; memb.

C0519+333 (NGC 1893)
(38.153.001) DDO, uvby, VRI phot; memb.

C0524+352 (NGC 1907)
(38.153.001) DDO, uvby, VRI phot; memb.

C0520+295 (Be 19)
(38.153.047) scanner sp; memb; abund.

C0528+342 (NGC 1931)
(41.153.004) UBV phot; var E; d; age.

C0530+341 (NGC 1960, M36)
(41.153.031) diam; E; d; LF.
(40.115.034) rot; sp types; B st.

C0532+099 (Orion)
Lee *et al.* (Yale) internal motions; vel distr.

C0532-054 (Trapezium)
(42.153.012) V,I_c phot; age; st density.
Herbig: low mass st formation; molecular clouds.

C0546+336 (King 8)
(38.153.033) th isochrones; age.
(38.153.047) scanner sp; memb; abund.

C0548+217 (Be 21)
(39.153.058) phot; d
C0551+003 (NGC 2112)
(39.153.007) uvby phot; E; d; age.
C0604+241 (NGC 2158)
(40.153.050) BV phot; sp; age; d. (41.153.042) erratum
(41.154.003) CMD; ft st.
C0605+243 (NGC 2168, M35)
(38.153.001) DDO, uvby, VRI phot; memb. (41.153.033) pm; memb; pg phot.
(42.153.043) internal motion; mass segregation
C0609+054 (NGC 2186)
(38.153.001) DDO, uvby, VRI phot; memb.
C0613-186 (NGC 2204)
Cameron and Reed (Cambridge,RGO) sp; rv; memb; blue stragglers; bin st.
Claria and Lapasset (Cordoba) UBV, CMT_1T_2 phot; RG; abund.
C0624-047 (NGC 2232)
(39.153.005) UBV, DDO phot; no RG memb. (42.153.045) Δa phot; search for CP2 st.
C0627-312 (NGC 2243)
Cameron and Reed (Cambridge,RGO) sp; rv; memb; blue stragglers; bin st.
C0629+049 (NGC 2244)
(39.153.065) dust shell; abs. (41.153.008) phot; sp; P-Q method; memb.
(40.114.173) UV ext,colors; O st. (41.131.005) UV E; d; memb.
C0632+084 (NGC 2251)
(38.153.001) DDO,uvby,VRI phot; memb.
C0638+099 (NGC 2264)
(39.153.029) star formation. (39.153.043) star formation
(39.153.050) IUE sp; X-ray em; chromospheric activity.
(39.153.005) UBV, DDO phot; no RG memb. (39.121.005) pre-ms st; Hα em.
(40.112.021) EXOSAT obs; st coronae. (41.153.025) memb; mass, age distributions.
(41.131.130) BV phot; abs. (42.116.052) rot vel; rapid rot.; evolution.
C0644-206 (NGC 2287)
(38.153.001) DDO, uvby, VRI phot; memb. (38.153.056) rot vel.
(40.153.019) rv. Ianna *et al.* (Virginia) pm; UBV phot; memb; d.
FitzGerald and Harris (Waterloo) UBV phot; st types; E; d; st counts; memb.
C0649+005 (NGC 2301)
(41.153.045) pm; memb
Claria and Lapasset (Cordoba) UBV, DDO phot; RG; abund.
C0652-245 (Cr 121)
(38.065.002) memb; initial mass; WR st (39.115.022) sp cl; abs mag.
C0701-207 (NGC 2324)
(41.153.046) pm; memb (41.123.035) var st.
C0704-100 (NGC 2335)
(39.153.005) UBV, DDO phot; probable RG memb.
C0705-105 (NGC 2343)
(39.153.005) UBV, DDO phot; probable RG memb. (42.153.045) Δa phot; search for CP2 st.
C0712-102 (NGC 2353)
FitzGerald and Harris (Waterloo) UBV phot; st types; E; d; st counts; memb.
C0712-256 (NGC 2354)
(42.153.046) BV phot; E; d.
C0716-248 (NGC 2362)
(41.153.039) abund.
C0721-131 (NGC 2374)
(39.153.040) pg, pe phot; E; d; age.
C0721-122 (Haff 8)
Claria and Lapasset (Cordoba) UBV, DDO, CMT_1T_2 phot; RG; abund.
C0722-321 (Cr 140)
(42.153.045) Δa phot; search for CP2 st.
C0722-261 (Ru 18)
(39.153.005) UBV, DDO phot; possible RG memb.

Claria and Lapasset (Cordoba) CMT_1T_2 phot; RG; abund.
C0724-287 (Ru 20)
Claria and Lapasset (Cordoba) UBV, DDO, CMT_1T_2 phot; RG; abund.
C0724-476 (Mel 66)
(38.153.045) Washington phot; abund. (42.153.016) Washington phot; RG; abund; CN.
Cameron and Reed (Cambridge, RGO) sp; rv; memb; blue stragglers; bin st.
Claria and Lapasset (Cordoba) UBV, DDO phot; RG; abund.
C0734-205 (NGC 2421)
(38.153.001) DDO, uvby, VRI phot; memb. (40.115.034) rot; sp types; B st.
C0734-143 (NGC 2422)
(38.153.001) DDO, uvby, VRI phot; memb. (38.153.034) uvby Hβ phot; age; d.
C0734-137 (NGC 2423)
Claria and Lapasset (Cordoba) UBV, DDO, CMT_1T_2 phot; RG; abund.
C0735+216 (NGC 2420)
(40.065.053) th isochrones; age. (39.153.035) rv; blue stragglers.
(42.153.033) st counts. (42.153.016) Washington phot; RG; abund; CN.
Fenkart (Basel) RGU phot; space densities.
Smith and Suntzeff (Texas, Mt.Wilson-Las Campanas) sp; rv; abund; giants.
Cameron and Reed (Cambridge,RGO) sp; rv; memb; blue stragglers; bin st.
C0735-119 (Mel 71)
(41.153.020) BV phot; E; d; age.
C0738-315 (NGC 2439)
(39.115.022) sp cl; abs mag. (40.115.034) rot; sp types; B st.
C0743-378 (NGC 2451)
(39.153.005) UBV, DDO phot; no RG memb. (40.153.033) wd search; 4 memb.
(42.153.013) δa phot; CP2 st; d. (39.115.022) sp cl; abs mag.
(42.153.035) uvby Hβ phot; E; B8 to A0 st; age.
C0745-271 (NGC 2453)
(41.134.006) VBLUW phot; E; d.
C0746-261 (Ru 36)
(39.153.020) UBV phot; E; d.
C0750-263 (NGC 2467)
(38.153.001) DDO, uvby, VRI phot; memb.
C0750-384 (NGC 2477)
Claria and Lapasset (Cordoba) UBV, DDO phot; RG; abund.
C0753-278 (NGC 2483)
(38.153.001) DDO, uvby, VRI phot; memb.
C0754-299 (NGC 2489)
Claria and Lapasset (Cordoba) UBV, DDO, CMT_1T_2 phot; RG; abund.
C0757-284 (Ru 44)
(38.065.002) memb; initial mass; WR st
C0757-106 (NGC 2506)
Cameron and Reed (Cambridge,RGO) sp; rv; memb; blue stragglers; bin st.
C0757-607 (NGC 2516)
(42.153.002) var st; phot. (40.115.034) rot; sp types; B st.
Claria and Lapasset (Cordoba) UBV, DDO phot; RG; abund.
C0759-193 (Ru 46)
(39.153.005) UBV, DDO phot; probable RG memb.
Claria and Lapasset (Cordoba) UBV, DDO phot; RG; abund.
C0802-461 (Cr 173)
(42.153.035) uvby Hβ phot; E; B8 to A0 st; age.
C0803-280 (NGC 2527)
(39.153.005) UBV, DDO phot; probable RG memb.
Claria and Lapasset (Cordoba) UBV, DDO, CMT_1T_2 phot; RG; abund
C0805-297 (NGC 2533)
(38.153.001) DDO, uvby, VRI phot; memb.
C0808-126 (NGC 2539)
(41.153.017) DDO, CMT_1T_2 phot; RG; E; d; age; abund.
(42.153.008) UBV phot; memb; E; d; age. (41.153.025) memb; mass, age distributions.

C0809-491 (NGC 2547)
(40.153.030) UBV Hβ, DDO phot; sp; rv; pre-ms. (41.153.038) uvby Hβ phot; d.
(42.153.035) uvby Hβ phot; E; B8 to A0 st; age.
C0810-374 (NGC 2546)
(38.153.001) DDO, uvby, VRI phot; memb. (39.153.005) UBV, DDO phot; probable RG memb.
C0811-056 (NGC 2548)
(39.153.005) UBV, DDO phot; probable RG memb. (40.153.019) rv.
C0816+304 (NGC 2567)
(39.153.005) UBV, DDO phot; probable RG memb.
(41.153.027) UBV, DDO, CMT_1T_2 phot; memb; E; d; age.
C0832-441 (Pi 4)
Claria and Lapasset (Cordoba) UBV, DDO, CMT_1T_2 phot; RG; abund.
C0837+201 (NGC 2632, Praesepe)
(38.153.014) rot;var; bin. (38.153.025) Li abund.
(38.153.033) th isochrones; age. (38.113.025) ms gap.
(41.153.022) sp; MK types; Am st; Ap st. (39.036.132) phot detection of bin
(40.117.282) contact bin; phot; ms (42.153.017) MK sp cl; faint st; d.
(42.122.068) UV-Ceti st in clusters. (42.153.016) Washington phot; RG; abund; CN.
C0838-528 (IC 2391)
(40.153.033) wd search; memb. (42.153.013) δa phot; CP2 st; d.
C0839-480 (IC 2395)
(42.153.045) Δa phot; search for CP2 st.
Claria and Lapasset (Cordoba) UBV, DDO, CMT_1T_2 phot; RG; abund.
C0843-486 (NGC 2670)
(38.153.001) DDO, uvby, VRI phot; memb.
C0846-423 (Tr 10)
(38.153.039) positions; pm; mag. (42.153.035) uvby Hβ phot; E; B8 to A0 st; age.
(42.153.045) Δa phot; search for CP2 st.
C0846+120 (NGC 2682, M67)
(40.065.053) th isochrones; age. (38.114.076) CNO abund; giants.
(39.153.013) Cousins VRI phot.
(39.153.064) UBV phot; pm; memb; RG; blue stragglers
(40.153.023) sp; RG; CNO abund. (40.153.027) phot; sp; abund; d.
(41.153.034) sp; metallicities. (39.153.057) uvby phot; ms st.
(40.113.061) RI phot. (42.153.051) Li abund
(42.153.036) precise rv; memb. (42.153.037) sp bin; blus stragglers; spatial distr.
(42.153.042) MgII,CaII em; RG (42.153.016) Washington phot; RG; abund; CN.
Brown (Texas) sp; CN abund; evolution.
Nissen *et al.* (Aarhus,Kansas,KPNO) uvby Hβ phot; E; d; age; abund.
Anthony-Twarog (Kansas) uvby phot; E; d; abund.
Claria and Lapasset (Cordoba) CMT_1T_2 phot; RG; abund.
C0915-495 (Pi 11)
(41.113.001) VBLUW phot; hypergiant membs
C0926-567 (IC 2488)
Claria and Lapasset (Cordoba) UBV, DDO phot; RG; abund.
C0939-536 (Ru 79)
(38.153.001) DDO, uvby, VRI phot; memb.
C0940-438 (Ru 80)
(39.115.022) sp cl; abs mag.
C1001-598 (NGC 3114)
(38.153.001) DDO, uvby, VRI phot; memb.
Claria and Lapasset (Cordoba) UBV, DDO, CMT_1T_2 phot; RG; abund
C1025-573 (IC 2581)
(39.117.061) UBV light curves; per; mass; age. (40.115.034) rot; sp types; B st.
C1033-579 (NGC 3293)
(39.115.022) sp cl; abs mag. (41.153.039) abund.
(41.122.018) β Cep var; ecl bin. (42.122.085) β Cep st; periods; modes.
(41.131.005) UV E; d; memb.
C1041-597 (Cr 228)

(38.065.002) memb; initial mass; WR st;
C1041-593 (Tr 14)
(40.114.173) UV ext,colors; O st. (41.131.005) UV E; d; memb.
C1043-594 (Tr 16)
(38.065.002) memb; initial mass; WR st; evol (40.153.031) sp cl.
C1057-900 (NGC 3496)
Claria and Lapasset (Cordoba) CMT_1T_2 phot; RG; abund.
C1104-584 (NGC 3532)
Claria and Lapasset (Cordoba) UBV, DDO phot; RG; abund.
C1112-609 (NGC 3603)
(38.153.026) WR st; sp; rv; bin. (38.065.002) memb; initial mass; WR st
C1123-429 (NGC 3680)
(42.153.016) Washington phot; RG; abund; CN.
C1133-613 (NGC 3766)
(39.153.002) uvby Hβ phot; Be st; E; st. (39.153.046) H II regions; bin.
(39.115.022) sp cl; abs mag. (40.115.034) rot; sp types; B st.
(41.112.012) Be st; var.
C1134-627 (IC 2944)
(41.153.039) abund. Walborn (STSI) sp types
C1141-622 (Stock 14)
(38.153.001) DDO, uvby, VRI phot; memb. (41.119.018) uvby light curves; ecl bin.
Peterson and FitzGerald (DAO) UBV phot; E; d
C1148-554 (NGC 3960)
Claria and Lapasset (Cordoba) CMT_1T_2 phot; RG; abund.
C1154-623 (Ru 97)
Claria and Lapasset (Cordoba) UBV, CMT_1T_2 phot; RG; abund.
C1222+263 (Mel 111)
(38.153.014) rot;var; bin. (39.153.013) Cousins VRI phot.
(42.153.044) sp types; rot vel; pec st. (41.153.043) Hα, OI phot.
(39.036.132) phot detection of bin (41.114.088) Fe abund.
(42.002.047) coordinate catalogue (42.112.133) CaII,MgII em; late ms st.
C1239-627 (NGC 4609)
Claria and Lapasset (Cordoba) UBV, DDO, CMT_1T_2 phot; RG; abund.
C1250-600 (NGC 4755)
(38.153.035) UBV phot;d; age; E(var). (40.115.034) rot; sp types; B st.
(41.153.039) abund.
C1315-623 (Stock 16)
(39.153.027) UBV phot; E; d; age.
C1317-646 (Ru 107)
Claria and Lapasset (Cordoba) UBV, DDO, CMT_1T_2 phot; RG; abund.
C1324-587 (NGC 5138)
Claria and Lapasset (Cordoba) UBV, DDO, CMT_1T_2 phot; RG; abund.
C1328-625 (Tr 21)
Peterson and FitzGerald (DAO) UBV phot; E; d
C1350-616 (NGC 5316)
Claria and Lapasset (Cordoba) UBV, DDO, CMT_1T_2 phot; RG; abund.
C1356-619 (Ly 1)
Peterson and FitzGerald (DAO) UBV phot; E; d
C1404-480 (NGC 5460)
(40.153.016) δa phot; CP2 st;
Claria and Lapasset (Cordoba) UBV, DDO, CMT_1T_2 phot; RG; abund
C1426-605 (NGC 5617)
Claria and Lapasset (Cordoba) UBV, DDO, CMT_1T_2 phot; RG; abund.
C1431-563 (NGC 5662)
Claria and Lapasset (Cordoba) UBV, DDO, CMT_1T_2 phot; RG; abund.
C1440+697 (Cr 285, U Ma)
(41.153.035) memb. (42.153.001) kinematics; origin; evolution.
C1445-543 (NGC 5749)
Claria and Lapasset (Cordoba) UBV, DDO phot; RG; abund.

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C1501-541 (NGC 5822)
(39.153.021) UBV, DDO, CMT_1T_2 phot; RG; memb; E; d; age; abund.
C1511-588 (Pi 20)
Peterson and FitzGerald (DAO) UBV phot; E; d
C1601-517 (Ly 6)
(39.153.014) d. (39.153.018) UBV phot; E; d; memb TW Nor.
C1609-540 (NGC 6067)
(38.153.001) DDO, uvby, VRI phot; memb. (39.153.019) UBV phot; E; d; Ceph memb.
(40.153.016) δa phot; CP2 st (41.122.020) Cep in cluster.
Claria and Lapasset (Cordoba) DDO, CMT_1T_2 phot; RG; abund.
C1614-577 (NGC 6087)
(42.153.018) UBV phot; Cep; E; d.
Claria and Lapasset (Cordoba) UBV,DDO phot; RG; abund.
C1624-490 (NGC 6134)
Claria and Lapasset (Cordoba) UBV, CMT_1T_2 phot; RG; abund.
C1642-469 (NGC 6204)
(38.153.001) DDO, uvby, VRI phot; memb.
C1650-417 (NGC 6231)
(38.153.054) IUE sp; mass loss. (38.065.002) memb; initial mass; WR st
(38.152.007) VBLUW phot; E; d; evol. (39.153.003) phot; β Cep instability strip
(39.112.006) B st; st winds. (40.114.173) UV ext,colors; O st.
(41.131.005) UV E; d; memb.
C1652-394 (NGC 6242)
Claria and Lapasset (Cordoba) UBV, DDO, CMT_1T_2 phot; RG; abund.
C1653-405 (Tr 24)
(38.153.003) UBV phot; d; E; age (40.152.008) phot; sp; memb; age; pre-ms st.
C1654-447 (NGC 6249)
Claria and Lapasset (Cordoba) UBV, DDO phot; RG; abund.
C1675-446 (NGC 6259)
(42.153.046) BV phot; E; d.
Claria and Lapasset (Cordoba) CMT_1T_2 phot; RG; abund.
C1701-378 (NGC 6281)
(38.153.015) Δa phot; CP2 st. (40.153.001) uvby phot; E; memb.
C1720-499 (IC 4651)
(42.153.047) ms turnoff, structure; E; d. (42.153.048) uvby phot; ms turnoff; age.
C1722-343 (Pi 24)
(38.065.002) memb; initial mass; WR st;
C1731-325 (NGC 6383)
(40.153.028) Walraven phot; E; d; sp; IR excess.
C1732-334 (Tr 27)
(38.065.002) memb; initial mass; WR st
C1734-349 (NGC 6396)
Claria and Lapasset (Cordoba) CMT_1T_2 phot; RG; abund.
C1736-321 (NGC 6405)
(38.153.015) Δa phot; CP2 st.
(40.153.001) uvby phot; E; memb; possible δ Sct st, CP1 st.
(39.115.022) sp cl; abs mag.
C1741-323 (NGC 6416)
(38.153.001) DDO, uvby, VRI phot; memb.
C1743+057 (IC 4665)
(38.153.015) Δa phot; CP2 st. (40.153.019) rv.
C1750-348 (NGC 6475)
(38.153.001) DDO, uvby, VRI phot; memb. (38.153.037) UBV phot; sp; bin; memb.
(38.113.025) ms gap. (40.153.002) rv; memb; sp bin orbit; high vel st.
C1753-190 (NGC 6494)
(41.113.023) Vilnius phot; E; d.
Claria and Lapasset (Cordoba) UBV, DDO, CMT_1T_2 phot; RG; abund
C1758+029 (Cr 359)
Rucinski (DAO) UBVRI phot; W UMa st; reality of cluster.

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C1801-225 (NGC 6531)
(41.153.039) abund.
C1801-243 (NGC 6530)
(38.153.055) UV sp; age; mass loss.
(39.153.043) star formation
(39.112.005) sp; line profiles; st winds.
(41.153.025) memb; mass, age distributions.
C1816-138 (NGC 6611)
(41.153.003) uvby phot; sp; abund.
(41.153.044) polarimetry
(41.153.025) memb; mass, age distributions.
(42.153.021) pm; memb.
C1825+065 (NGC 6633)
(40.153.019) rv.
(39.153.035) rv; blue stragglers.
(41.113.020) Vilnius phot; E; memb; RG.
(42.153.016) Washington phot; RG; abund; CN.
C1828-192 (IC 4725, M 25)
(38.153.001) DDO, uvby, VRI phot; memb.
(40.153.016) δa phot; CP2 st;
C1830-104 (NGC 6649)
Walker and Laney (SAAO) UBV phot; Cep; d; E; var st.
C1834-082 (NGC 6664)
(38.153.001) DDO, uvby, VRI phot; memb.
C1836+054 (IC 4756)
(40.153.020) pm technique; memb.
Claria and Lapasset (Cordoba) CMT_1T_2 phot; RG; abund.
C1842-094 (NGC 6695)
(38.153.001) DDO, uvby, VRI phot; memb.
C1848+102 (NGC 6705, M 11)
(38.153.027) pm; lf; str; dyn.
(42.153.036) precise rv; memb.
(42.153.016) Washington phot; RG; abund; CN.
C1850-204 (Cr 394)
(40.153.006) UBV, VRI phot; E; d; Cep memb.
C1851-199 (NGC 6716)
(40.153.006) UBV, VRI phot; E; d.
C1905+041 (NGC 6755)
(38.153.001) DDO, uvby, VRI phot; memb.
(39.153.035) rv; blue stragglers.
C1909+129 (Be 82)
(41.153.022) UBV phot; memb; E; d; RG; age.
C1919+377 (NGC 6791)
(38.153.050) DDO, UBV phot; RG; d; abund; E.
(39.153.023) phot; ms; d.
(42.153.016) Washington phot; RG; abund; CN.
C1923+200 (Cr 399)
(41.113.019) Vilnius phot; bright st; RG.
C1939+400 (NGC 6819)
(42.153.016) Washington phot; RG; abund; CN.
C1941+231 (NGC 6823)
(41.153.025) memb; mass, age distributions.
C1947+272 (S Vul)
(40.153.012) new cluster; st counts; d; S Vul; Cep.
(42.153.015) UBV phot; E; d; age; Cep memb.
C2004+356 (NGC 6871)
(38.153.036) uvby Hβ phot, var.
(38.065.002) memb; initial mass; WR st
C2009+264 (NGC 6882)
(38.153.006) E; d.
(39.153.035) rv, blue stragglers
(41.113.019) Vilnius phot; bright st; RG.
C2009+263 (NGC 6885)
(38.153.006) E; d.
(39.153.035) rv, blue stragglers
(41.113.019) Vilnius phot; bright st; RG.
C2014+374 (IC 4996)
(39.153.006) uvby Hβ phot; E; d; age.
(40.153.003) var st search; bin; β Cep st.
C2018+392 (Har 5)
Claria and Lapasset (Cordoba) UBV, DDO phot; RG; abund.
C2022+383 (NGC 6913)
(41.153.025) memb; mass, age distributions.
C2032+281 (NGC 6940)

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(40.153.019) rv.
C2109+454 (NGC 7039)
Schneider (Göttingen) uvby Hβ phot; E; d; reality of cluster.
C2121+461 (NGC 7062)
(38.153.029) rv, blue stragglers
C2122+362 (NGC 7063)
(38.153.001) DDO, uvby, VRI phot; memb. Schneider (Göttingen) uvby Hβ phot; E; d.
C2128+487 (Anon.)
(42.153.031) reality of cluster.
C2130+482 (NGC 7092, M 39)
(38.153.013) memb. (39.153.011) UBV phot; E; d; age.
(40.153.019) rv. (42.153.044) sp types; rot vel; pec st.
(42.153.010) δa phot; CP2 st.
C2137+573 (Tr 37)
(39.153.037) UV E; B st; dust.
Clayton and Fitzpatrick (Wisconsin, JILA) UV sp; E; dust.
Marschall and van Altena (Gettysburg, Yale, in press) pm.
C2151+470 (IC 5146)
(38.153.022) UBVRI phot; n st; age.
C2210+570 (NGC 7235)
(38.153.001) DDO, uvby, VRI phot; memb.
C2245+578 (NGC 7380)
(40.132.038) 21 cm em, cont obs; evolutionary history
C2306+602 (Ba 2)
(39.153.004) UBV phot; E; A; d; memb; earliest sp
C2309+603 (NGC 7510)
(38.153.001) DDO, uvby, VRI phot; memb.
(39.153.004) UBV phot; E; A; d; memb; earliest sp
(41.131.112) OIII, NII, SII phot.
C2313+601 (BA 3)
(39.153.004) UBV phot; E; A; d; memb; earliest sp (41.131.112) OIII, NII, SII phot.
C2313+602 (MA 50)
(38.065.002) memb; initial mass; WR st
C2322+613 (NGC 7654)
(38.153.001) DDO, uvby, VRI phot; memb.
(39.153.004) UBV phot; E; A; d; memb; earliest sp
C2343+619 (Stock 2)
(42.153.006) UBV phot; E; d; age.
C2347+624 (King 21)
(38.153.041) phot; E; d; age.
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(38.153.023) phot; E; d; age.
C2354+564 (NGC 7789)
(38.153.007) Li abund. (40.153.007) uvby phot; blue stragglers.
(40.153.037) sp; giants; met abund. (41.153.006) C isotope ratio; wk G-band st.
(41.153.001) Li abund. (42.153.016) Washington phot; RG; abund; CN.
C2355+609 (NGC 7790)
(38.153.049) UBV phot; E; d; bin.

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Smith, V.V. and Suntzeff, N.B., 1987, *Astron. J.* **93**, 359.
Sowell, J.R. 1987, *Astrophys. J. Suppl.* **64**, 241.
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Terlevich, E. 1987, *Mon. Not. Roy. Astron. Soc.* **224**, 193.
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6. Globular Star Cluster Research

INTRODUCTION

The present compilation has been prepared from the literature cited in *Astronomy and Astrophysics Abstracts*, **37-42** inclusive, representing the contributions from 1984 through 1986. What is presented below is a condensed version of the original report, which is Preprint No.765 of the Steward Observatory. As much as possible, only those papers which present or analyze observational data have been included

here. Review articles, syntheses of data, theoretical and/or numerical modelling papers, and citations of abstracts have not been incorporated into this Report; otherwise, its length would have been doubled, easily. As has become a standard format, the literature citations are arranged under each relevant cluster. Papers which refer to data from more than ten clusters, or to a specific and complete set thereof (e.g. the eight X-ray globulars), may be found in the 'Catalogues' section, at the beginning of the tabular information; multiple listings occur under the relevant clusters' IAU designation for those papers in which ten or fewer clusters are analyzed. Finally, all of the known clusters are listed in order of their IAU 'C' designation, ignoring the resultant scrambling of NGC numbers. The purpose of the listing is two-fold: 1) to provide the community with an up-to-date reference, in correct IAU 'C' order, of the known clusters; and, 2) to see how many important clusters are being ignored in favor of the 'biggest and brightest'. The large telescope/CCD combinations should be put to use on these fainter, more sparse, and extremely important members of the cluster sub-system of our Galaxy.

Following the request to this writer by the Commission President three years ago, and repeated by the incumbent this year, the Report also includes the relevant citations for the globular star clusters in both Magellanic Clouds, and in external galaxies. The length of their tables is an accurate statement of the ease with which the CCD, coupled to a large telescope, permits reliable work at formerly heroic levels of apparent faintness.

GLOSSARY OF ABBREVIATIONS

1-D = one-dimension(al)
ass = association(s)
bin. = binar-y,-ies
CCD = charge-coupled device
comp. = com-pare(d), -parison
d = distance(s)
disp. = dispersion
dwf. = dwarf
electronogr. = electronographic
est. = estimate,-ed
gal. = galaxy, galactic
IMF = initial mass function
interp. = inter-pret(ed),-pretation
I.T. = image tube
lf,LF = luminosity function
meas. = measure(d)
modif. = modi-fy, -fication
obj. = object(s), objective
par = parameter(s)
pg = photographic
pm, PM = proper motion
prelim. = preliminary
RG(B) = red giant(s) (branch)
SB = spectroscopic binary
sp. = spectr-a,-al,-oscopic
stf = star formation
surf. = surface
UV = ultraviolet
vel. = velo-city,-cities

abund. = abundance(s)
astrom = astrometr-y,-ic
br. = bright, -er, -ness
chem. = chemical
csc = cosecant
determ. = determin-e(d),-ation
dist. = distance
dyn. = dynamic,-al,-s
ellip. = elliptical
evol = evolution,-ary
Gyr. = 10^9 yrs.
I/S = interstellar
IR = infra-red
IUE = International UV Explorer
m.-p. = metal-poor
memb. = member, -ship
mol = molecular
obs. = observ-ation(s), -ed
p.e. = photo-electric
phot. = photomet-er,-ric,-ry
PN = planetary nebula(e)
resol. = resolve(d), resolution
rot. = rotation,-al
SG = supergiants
spphot = spectrophotometry
str. = strength(s)
temp. = temperature
v. = very

AGB = asymptotic giant branch
BHB = blue horizontal branch
c.c. = chemical composition
cl. = cluster
cts. = counts
discov. = dis-covery, -covered
distr,-ib. = distribut-ed,-ion
E = colour excess, reddening
em = emission
ex = extinction
HB = horizontal branch
integr. = integrated
ist = interstellar
kin. = kinemati-c,-cal,-cs
m.-r. = metal-rich
metal. = metall-ic , -icity
ms = main sequence
PAGB = post-AGB
pec = peculiar
photog. = photogra-phy, -phic
pol = polarization
red. = reddening
rv,RV = radial velocity
SN = supernova
st. = star(s), stellar
subgt. = subgiant
theo. = theoretical
var. = variable

CATALOGUES OF CLUSTER DATA

Bica, E. & D. Alloin (42.154.001) - integr. sp. of 63 cl.; grids of st. cl. properties.

Brodie, J.P. & D.A. Hanes (41.154.001) - abs. line indices from low-disp. sp. lead to [Fe/H]-values for 36 cl.

Burstein, D. *et al.* (38.154.081) - integr. sp. of 17 cl. in the Galaxy comp. to the same for 19 cl. in M31; sp. indices comp. to ellip. gal.

Caloi, V. *et al.* (38.154.030) - IUE sp. of cl. central regions.

Djorgovski, S. & I.R. King (41.154.066) - surf. phot. of 100+ cl.; 20% show signs of collapsed cores.

Ehjegenson, A.M. & O.S. Yatsyk (42.154.002) - generalized characteristics for 97 cl. from 'principal

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component method'.
Gratton, R.G. (39.154.027) - phot. data of MS st. in 26 cl.
Gratton, R.G. & S. Ortolani (40.154.045) - dist. and ages for 26 cl. with MS phot.
Grindlay, J.E. *et al.* (38.142.009) - *Einstein* obs. of X-ray cl.; tidal-capture hard binary X-ray sources have $0.9 \leq M/M_{\odot} \leq 1.9$.
Hamuy, M. (38.154.003) - integr., half-light, UBVRI p.e. photom. for 72 cl.
Hamuy, M. (41.154.009) - multi-aperture, integr., UBVRI phot. of 79 southern cl.; incorporates data in (38.154.003).
Hanes, D.A. (38.154.020) - integr. UBV p.e. photom. for 31 cl. with $\delta < +12°$.
Hanes, D.A. & J.P. Brodie (39.154.070) - multi-aperture UBVRI phot. for 71 cl.
Hesser, J.E. & S.J. Shawl (40.154.009) - I.T., integr., 1-D, sp. types for 90 cl.
Hesser, J.E. *et al.* (41.154.057) - RV investigation from I.T. sp. of 90 cl.
Kron, G.E. *et al.* (37.154.042) - partial surf. br. profiles for 69 cl. with use of electronic camera.
Kron, G.E. & K.C. Gordon (41.154.068) - br. distrib. from multi-aperture BVRI obs. of 21 cl.
Lugger, P.M. *et al.* (39.154.059) - CCD UBVR surf. phot. of 11 cl. sample to test for presence of central cusps in surf. br. profile.
Lee, S.-W. (41.154.062) - 16 well-obs. cl. with [Fe/H] used to determine age and Y.
Peterson, C.J. (41.154.022) - BV surf. phot., concentric apertures, of 101 cl.
Peterson, R.C. *et al.* (42.111.003) - high precision RV for RG st. in eight nearby and four remote cl.
Petrovskaya, I.V. & A.M. Ehjgenson (37.154.035) - age correlations of 51 cl. with metal., mean density.
Reed, B.C. (39.154.008) - integr. UBVRI phot. of 114 cl. reduced to van den Bergh UBV and Hamuy VRI systems.
Rose, J.A. (40.157.056) - integr. sp. of 10 cl. (and one open cl.: M 67) comp. to 12 ell. gal.
Shawl, S.J. & R.E. White (41.154.031) - accurate ($\pm 1''$) optical positions of 109 cl. centers.
Smith, H.A. (37.154.055) - ΔS-index correlated with RGB $(V-K)_0$; Zinn's Q_{39} metal. index re-calibrated in terms of [Fe/H] via ΔS-index.
Webbink, R.F. (39.154.069) - obs. and derived structural parameters tabulated for 154 cl. in Galaxy, 6 cl. in Fornax, and 7 dwf. spheroidals.
White, R.E. & S.J. Shawl (43.154.xxx) - axial ratios and Galactic orientation for 105 cl.
van den Bergh, S. & C.L. Morbey (38.154.075) - cl. radii correlated more strongly with Galactocentric distance than are metal.
Zasov, A.V. *et al.* (40.154.008) - E(B-V) dependence upon gal. lat., b; csc-law.
Zinn, R. (39.154.072) - spatial distrib., kin.s, and metal. for 121 cl.
Zinn, R. & M.J. West (37.154.047) - RV and metal. meas. for 60 cl.; compilation of metal. for 121 cl.

CLUSTER-BY-CLUSTER LITERATURE CITATIONS

C0021-723 (NGC 104, 47 Tuc)
(39.154.025) - UBVRI p.e. seq. (24 st.).
(38.154.016) - computed synthetic sp. comp. to low-disp. sp. obs.
(39.154.056) - RV for cl. memb.; dynam. study. (38.154.021) - low-disp. IUE sp. of UV-br. st.
(37.154.034) - photog. UV surf. phot.; search for UV-excess similar to that shown by NGC 7078 (M 15).
(39.114.021) - high-disp. sp. analysis of 13.5-mag. RG st.
(39.154.052) - chem. and kin. prop.; chem gradient.(39.154.074) - importance of st. RV in dyn. studies.
(41.154.043) - TiO absorption features in high-resol. sp. of RG st.
(42.154.018) - high-disp. sp. comp. to Arcturus for [Fe/H].
(37.154.012) - BV CMD to MS. (38.154.012) - review of cl. parameters.
(39.154.058) - CCD BV phot. to obtain CMD and LF to $B_{lim} \approx 25$.
(40.154.056) - photog. phot. of 1200 st., $13.5 < V < 17.5$; BV CMD and LF.
(38.154.011) - RG st. in cl. sp. comp. to RG st. in NGC 6723.
(42.154.031) - central depths for CH- and CN-features and prominent abs. lines of Fe I, Ca I, Sr II, Ba II, and H for 22 RG st.
(37.154.040) - kin. studies of 169 st.; no sp. bin. detected.
(39.154.078) - RV of 169 RG st.; cl. rot. and vel. disp.
(39.154.060) - CORAVEL RV study; virial mass, M/L.
(41.154.010) - kin. and dyn. from 272 memb. st. RV.
(38.154.024) - Walraven (VBLUW) phot. of RG st.; [Fe/H]-values determined.
(37.154.032) - CN and CH anticorrelated on RGB.
(40.154.039) - Sabbatier technique to produce isodensity contours; ellipticity.

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(40.154.014) - theo. isochrone fits to cl. with UBVRI and Strömgren uvby p.e. phot.

C0050-268 (NGC 288)

(37.154.063) - photom. to cl. MS.
(38.154.043) - cl. CMD shows gap in subgt. branch; interp., modif. to theory.
(38.154.016) - computed synthetic sp. comp. to low-disp. sp. obs.
(37.154.030) - BV CMD from 3000 st. images; $Y = 0.23 \pm 0.03$.
(38.154.002) - BV CMD from 2350 st. images; [Fe/H] ≈ -1.4.
(42.154.031) - central depths for CH- and CN-features and prominent abs. lines of Fe I, Ca I, Sr II, Ba II, and H for 1 RG st.
(37.154.056) - BV CMD to V= +21.
(37.154.044) - electronogr. BV CMD to V= +21; age determ.
(37.154.064) - electronogr. and CCD photom.
(40.116.004) - $< RV >= -43.2 \pm 1.5 kms^{-1}$ from 7 st.; line-broadening obs. give $v \sin i = 22 \pm 3 kms^{-1}$.
(37.154.012) - BV CMD to MS.
(38.154.024) - Walraven (VBLUW) phot. of RG st.; [Fe/H]-values determined.

C0100-711 (NGC 362)

(38.154.016) - computed synthetic sp. comp. to low-disp. sp. obs.
(40.154.051) - CO and CN band str. among RG st.
(42.154.024) - Washington phot.; temp., abund., memb.
(42.154.031) - central depths for CH- and CN-features and prominent abs. lines of Fe I, Ca I, Sr II, Ba II, and H for 2 RG st.
(38.154.024) - Walraven (VBLUW) phot. of RG st.; [Fe/H]-values determined.
(38.154.037) - CN variations among RG st.

C0234+209 (DEJC 1)

C0310-554 (NGC 1261)

(38.154.040) - UBVRI p.e. seq.

C0325+794 (Pal 1)

(40.154.046) - prelim. BV CMD.

C0345-718 (NGC 1466)

C0354-498 (AM 1, E 1)

(37.154.005) - BV CMD, est. [Fe/H]= -1.8.
(37.154.070, 38.154.018) - CCD-derived BV CMD to $V_{lim} = +23$.
(40.154.003) - sp. of two RG st.; [Fe/H] $= -1.7 \pm 0.2$, $RV = +116 kms^{-1}$.

C0422-213 (Erid 1)

(39.154.022) - CCD BV CMD; m-M= 19.95.
(40.154.015) - RV ($\pm 15 kms^{-1}$) to est. Galaxy's mass.
(41.154.007) - CCD BV CMD, st. cts., to $V_{lim} \approx 23.5$.
(42.154.042) - cl. age from CMD.

C0433+313 (Pal 2)

C0444-840 (NGC 1841)

C0512-400 (NGC 1851, 4U 0512-401)

(37.154.034) - photog. UV surf. phot.; search for UV-excess similar to that shown by NGC 7078 (M 15).
(41.142.033) - 6h obs. baseline of soft- and medium- energy X-ray light-curves.
(41.154.004) - BV and DDO p.e. phot.; radial color gradients.

C0522-245 (NGC 1904, M79)

(42.154.008) - CCD BV CMD to below MS turnoff. (37.154.012) - BV CMD to MS.
(41.154.053) - CCD BV CMD below MS turnoff.
(38.154.024) - Walraven (VBLUW) phot. of RG st.; [Fe/H]-values determined.

C0536-618 (E 2)

(42.154.037) - BV CMD; comp. with VandenBerg models gives age of 1.5 Gyr; same dist. as LMC; LMC cl.?

C0647-359 (NGC 2298)

(41.154.024) - CCD BVRI CMD. (42.154.008) - CCD BV CMD to below MS turnoff.

C0734+390 (NGC 2419)

C0737-337 (AM 2)

C0911-646 (NGC 2808)

(41.154.029) - p.e. UBVRI seq. in field. (37.154.039) - BV CMD to $V_{lim} = +21$.
(37.154.045) - BVRI Reticon profiles. (42.154.008) - CCD BV CMD to below MS turnoff.
(41.154.004) - BV and DDO p.e. phot.; radial color gradients.

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C0921-770 (E 3)
(37.154.072) - BV CMD. (40.154.017) - CCD BV CMD.
C0923-545 (UKS 2)
C1003+003 (Pal 3)
(38.154.044) - CCD photom. to V about 23.2; BV CMD.
(42.154.042) - cl. age from CMD.
C1015-461 (NGC 3201)
(37.154.063) - photom. to cl. MS. (38.154.040) - UBVRI p.e. seq.
(40.154.051) - CO and CN band str. among RG st. (37.154.064) - electronogr. and CCD photom.
C1052+407 (SAHB 1)
C1126+292 (Pal 4)
(41.154.026) - CCD BV CMD to $V_{lim} \approx 25$. (41.154.019) - st. RV; $M_{Galaxy} = (5 \pm 2) \times 10^{11} M_{\odot}$.
(41.154.028) - CCD BV CMD to $V_{lim} \approx 24.8$.
C1207+188 (NGC 4147)
(40.154.012) - space motion from PM of 39 st.
C1223-724 (NGC 4372)
(41.154.029) - p.e. UBVRI seq. in field.
C1236-264 (NGC 4590, M68)
(38.154.040) - UBVRI p.e. seq. (37.154.064) - electronogr. and CCD photom.
C1256-706 (NGC 4833)
42.154.035) - JHK phot. for 21 RG st.
C1310+184 (NGC 5024, M53)
C1313+179 (NGC 5053)
C1323-472 (NGC 5139, ω Cen)
(38.154.040) - UBVRI p.e. seq.
(38.154.043) - cl. CMD shows gap in subgt. branch; interp., modif. to theory.
(38.114.069) - IUE sp. of st. ROA 5701; T_{eff} and M_{bol}.
(40.114.151) - c.c. and abund. of RG st.
(41.154.065) - CNO abund. from sp. and narrow-band phot. of 72 st.
(40.114.128) - ROA 577, RV and PM memb. of cl., is CH st.
(42.154.025) - sp. of six candidate blue stragglers; RV; st. E39 is dwf. Cepheid (AI Vel) var.
(39.154.052) - chem. and kin. prop.; chem. gradient.
(39.154.074) - importance of st. RV in dyn. studies.(40.154.011) - SIT Vidicon sp. of subgt. st.
(39.154.032; Engl. transl.: 40.154.049) - scanner obs. of 2 HB st. (1403 and 1853).
(42.154.031) - central depths for CH- and CN-features and prominent abs. lines of Fe I, Ca I, Sr II, Ba II, and H for 217 RG st.
(39.154.078) - RV of 298 RG st.; cl. rot. and vel. disp.
(39.154.060) - CORAVEL RV study; virial mass, M/L.
(41.154.010) - kin. and dyn. from 318 memb. st. RV.
(38.154.063) - large cl. mass deduced from virial theorem and tidal radius determination.
(41.154.004) - BV and DDO p.e. phot.; radial color gradients.
(37.154.014) - BV CMD to MS.
(40.154.039) - Sabbatier technique to produce isodensity contours; ellipticity.
(41.154.027) - BHB st. radial distrib.
(42.154.044) - sp. of RR Lyr var. to derive state of HB evol.; Sandage period-shift effect half of Sandage's result.
(42.154.017) - EXOSAT obs. of 2 soft X-ray sources discov. by Einstein satellite.
C1339+286 (NGC 5272, M3)
(39.154.001) - low-disp. IUE sp of UV-br. st.
(42.154.046) - BV CMD from high precision phot. of 10000 st. with internal $\delta m \approx \pm 0.03$ and $V_{lim} \approx 22$.
(38.154.021) - low-disp. IUE sp. of UV-br. st. (39.154.074) - importance of st. RV in dyn. studies.
(40.154.051) - CO and CN band str. among RG st.
(40.154.010; Engl.transl.: 41.154.049) - cl. rot. using Griffin/Gunn RV.
(39.154.080) - bi-modal CN distrib. interpreted by mixing scenario.
(40.154.054) - sp. obs. of 9 st. pairs (one st. N-rich, the other N-poor); comp. to NGC 104 (47 Tuc) and NGC 6752 results.
(38.154.077) - CN variations of st. on lower RGB.
(39.154.062) - RV for 112 RG st.; no convincing evidence for SB systems.

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(39.154.063) - deep Hβ narrow- and wideband images of cl. to search for cataclysmic bin.; none found brighter than $M_B = 6$.
(37.116.011) - discovery of intrinsic polarization in some RG st.
C1343-511 (NGC 5286)
(40.154.022) - BV CMD.
C1354-269 (AM 4)
C1403+287 (NGC 5466)
(37.154.029) - BV CMD for stars br. than B = +19(39.154.009) - photog. phot.; BV CMD.
(40.154.019) - BV CMD to fainter than MS turnoff.
(39.154.028) - galactic orbit highly inclined ($80° \pm 10°$) to plane and v. eccentric ($e > 0.7$).
(41.154.064) - RV and vel. disp.
C1427-057 (NGC 5634)
C1436-263 (NGC 5694)
C1452-820 (IC 4499)
C1500-328 (NGC 5824)
(37.154.034) - photog. UV surf. phot.; search for UV-excess similar to that shown by NGC 7078 (M 15).
C1513+000 (Pal 5)
(40.154.025) - br. RG st. sp.; [Fe/H] = -1.4, CN strength varies.
(41.154.052) - CCD BV CMD.
C1514-208 (NGC 5897)
(40.154.002) - sp. of non-var. st. (SK 120) in RR Lyr gap.
C1516+022 (NGC 5904, M5)
(39.154.001) - low-disp. IUE sp of UV-br. st. (37.154.051) - PM for var. and other unusual st.
(39.154.029) - UV-images of cl. at 1540Åand 2360Å.
(41.153.034) - $< \Delta Fe >$ defined and meas. for individual st.
(40.154.051) - CO and CN band str. among RG st. (38.154.021) - low-disp. IUE sp. of UV-br. st.
(42.154.018) - high-disp. sp. comp. to Arcturus for [Fe/H].
(39.154.032; Engl. transl.: 40.154.049) - scanner obs. of HB st. (I-6).
(39.154.080) - bi-modal CN distrib. interpreted by mixing scenario.
(39.154.089) - synth. sp. fit to low-resol. sp. of 3 CN-strong and 3 CN-weak RG st.; all have similar lum. and T_{eff}.
(40.154.054) - sp. obs. of nine st. pairs (one st. N-rich, the other N-poor); comp. to NGC 104 (47 Tuc) and NGC 6752 results.
C1524-505 (NGC 5927)
(38.154.052) - narrow-band p.e. phot. of TiO strength, leading to $[m/H] = -0.4 \pm 0.2$.
C1531-504 (NGC 5946)
C1542-376 (NGC 5986)
(38.113.030) - p.e. UBV seq. of 22 st. around cl.
C1608+150 (Pal 14)
(38.154.062) - st. cts., BV CMD.
(40.154.015) - RV ($\pm 15 kms^{-1}$) to est. Galaxy's mass.
(41.154.019) - st. RV; $M_{Galaxy} = (5 \pm 2) \times 10^{11} M_{\odot}$.
C1614-228 (NGC 6093, M80)
(37.154.034) - photog. UV surf. phot.; search for UV-excess similar to that shown by NGC 7078 (M 15).
C1620-720 (NGC 6101)
C1620-264 (NGC 6121, M4)
(37.154.063) - photom. to cl. MS.
(38.154.036) - BVRI p.e. and photog. photom.; BV CMD.
(39.154.004) - red., m-M, and age from RR Lyr properties.
(41.154.010) - search for UV-excess st. to identify wd component; UBV phot. of 6 objects consistent with hot wd.
(42.154.024) - Washington phot.; temp., abund., memb.
(42.154.018) - high-disp. sp. comp. to Arcturus for [Fe/H].
(37.154.038) - BHB st. [Fe/H] = -0.4.
(42.154.031) - central depths for CH- and CN-features and prominent abs. lines of Fe I, Ca I, Sr II, Ba II, and H for 2 RG st.
(40.154.054) - sp. obs. of 9 st. pairs (1 st. N-rich, the other N-poor); comp. to NGC 104 (47 Tuc) and NGC 6752 results.

(39.116.021) - rot. of HB st.; $< RV >= 72.3 \pm 0.9 kms^{-1}$ (9 st.); no rot. larger than $v \sin i = 15 kms^{-1}$ for any of the 9 st.
(41.154.064) - RV and vel. disp. (41.154.050) - JHK phot. of RG and HB st.
(37.154.031) - UBV CMD from CCD photom. (37.154.062) - CCD-derived CMD; isochrones.
(40.154.014) - theo. isochrone fits to cl. with UBVRI and Strömgren p.e. phot.
C1624-259 (NGC 6144)
C1624-387 (NGC 6139)
(38.154.038) - p.e. BV seq.
C1625-325 (Ter 3)
C1629-129 (NGC 6171, M107)
(38.154.008) - BV CMD to MS turnoff $\Rightarrow [Fe/H] = -0.9$.
(42.154.031) - central depths for CH- and CN-features and prominent abs. lines of Fe I, Ca I, Sr II, Ba II, and H for 2 RG st.
(38.154.010) - BV CMD to $V_{lim} = 21$ and $B_{lim} = 21.5$.
(42.154.023) - DDO phot. of RG st.
C1639+365 (NGC 6205, M13)
(39.154.001) - low-disp. IUE sp of UV-br. st.
(40.154.051) - CO and CN band str. among RG st. (39.154.055) - dyn. modelling from PM of indiv. st.
(38.154.021) - low-disp. IUE sp. of UV-br. st. (41.154.005) - p.e. BVRI seq. (20 st.) in field.
(39.154.032; Engl. transl.: 40.154.049) - scanner obs. of 2 HB st. (II-25, AJ-63) show cl. He-abund. is nearly normal.
(39.154.080) - bi-modal CN distrib. interpreted by mixing scenario.
(41.154.054) - high-res. CCD sp. of 4 st.; O-, Sc-, Fe-, and La-abund.
(39.154.051) - RV and PM techniques for indiv. st. (41.154.032) - UBV CMD, mass function.
(38.154.017) - PM used to determine cl. mass.
(40.154.054) - sp. obs. of 9 st. pairs (1 st. N-rich, the other N-poor); comp. to NGC 104 (47 Tuc) and NGC 6752 results.
(41.154.037) - CCD UBV CMD fainter than V = 25.
(37.116.011) - discovery of intrinsic polarization in some RG st.
C1644-018 (NGC 6218, M12)
(38.154.069) - p.e. photom. of faint st.
C1645+476 (NGC 6229)
(40.154.019) - BV CMD to fainter than MS turnoff.
C1650-220 (NGC 6235)
C1654-040 (NGC 6254, M10)
(39.154.001) - low-disp. IUE sp of UV-br. st. (38.154.021) - low-disp. IUE sp. of UV-br. st.
(38.154.069) - p.e. photom. of faint st. (37.154.071) - BV CMD.
C1656-370 (NGC 6256)
C1657-004 (Pal 15)
(38.154.062) - st. cts., BV CMD. (41.154.019) - st. RV; $M_{Galaxy} = (5 \pm 2) \times 10^{11} M_{\odot}$.
C1658-300 (NGC 6266, M62)
(39.154.017) - IUE obs. of cental region; brightest cl. in UV so far.
C1701-246 (NGC 6284)
C1702-226 (NGC 6287)
C1707-265 (NGC 6293)
C1711-294 (NGC 6304)
C1713-280 (NGC 6316)
C1714-237 (NGC 6325)
C1715+432 (NGC 6341, M92)
(39.154.001) - low-disp. IUE sp of UV-br. st. (39.154.009) - photog. phot.; BV CMD.
(40.154.051) - CO and CN band str. among RG st. (42.154.013) - CCD BV CMD.
(39.154.032; Engl. transl.: 40.154.049) - scanner obs. of 2 HB st. (II-40 and II-27).
(41.154.059) - subgt. st. C-abund. (39.154.051) - RV and PM techniques for indiv. st.
(38.154.017) - PM used to determine cl. mass.
(40.154.054) - sp. obs. of 9 st. pairs (1 st. N-rich, the other N-poor); comp. to NGC 104 (47 Tuc) and NGC 6752.
C1716-184 (NGC 6333, M9)
C1718-195 (NGC 6342)
C1720-177 (NGC 6356)

C1720-263 (NGC 6355)
(38.154.038) - p.e. BV seq.
C1721-484 (NGC 6352)
(38.154.082) - [Fe/H]-value from Washington phot. and echelle sp.
(42.154.024) - Washington phot.; temp., abund., memb.
(38.154.052) - narrow-band p.e. phot. of TiO strength, leading to $[m/H] = -0.5 \pm 0.2$.
C1724-307 (Ter 2, 4U 1722-30)
(40.142.093, 41.142.112) - EXOSAT obs. over 11h baseline; sp., lum. consistent with Einstein obs.; quasi-periodic oscillations energy range 2-8 kev.
C1725-050 (NGC 6366)
(40.154.004) - structure.
C1726-670 (NGC 6362)
(41.154.030) - CCD BVRI CMD.
C1727-315 (Ter 4)
C1727-299 (HP 1)
C1729-338 (Grindlay 1)
C1730-333 (Liller 1)
C1731-390 (NGC 6380)
C1732-304 (Ter 1)
C1732-385 (Pismis 26)
C1732-447 (NGC 6388)
(37.154.045) - BVRI Reticon profiles.
(41.154.004) - BV and DDO p.e. phot.; radial color gradients.
C1733-390 (Ton 2)
C1735-032 (NGC 6402, M14)
C1735-238 (NGC 6401)
C1736-536 (NGC 6397)
(37.154.063) - photom. to cl. MS.
(38.154.021) - low-disp. IUE sp. of UV-br. st.
(41.154.029) - p.e. UBVRI seq. in field.
(42.154.064) - sp. of 4 BHB st.
(42.114.056) - sdO st. ROB 162 has $T(3)_{eff} = 51 \pm 2° K$; resembles m.-p. central st. of PN; is a PAGB st.
(37.154.038) - BHB st. [Fe/H] = -1.4.
C1740-262 (Pal 6)
C1742+031 (NGC 6426)
C1745-247 (Ter 5)
C1746-203 (NGC 6440)
(37.154.034) - photog. UV surf. phot.; search for UV-excess similar to that shown by NGC 7078 (M 15).
C1746-370 (NGC 6441)
(37.154.034) - photog. UV surf. phot.; search for UV-excess similar to that shown by NGC 7078 (M 15).
(41.154.004) - BV and DDO p.e. phot.; radial color gradients.
C1747-312 (Ter 6)
C1748-346 (NGC 6453)
(38.154.038) - p.e. BV seq.
C1751-241 (UKS 1)
C1755-442 (NGC 6496)
(38.154.038) - p.e. BV seq.
C1758-268 (Ter 9)
C1759-089 (NGC 6517)
C1800-260 (Ter 10)
C1800-300 (NGC 6522)
(40.154.048) - BV CMD.
C1801-003 (NGC 6535)
C1801-300 (NGC 6528)
C1802-075 (NGC 6539)
C1804-437 (NGC 6541)
(41.154.004) - BV and DDO p.e. phot.; radial color gradients.
C1804-250 (NGC 6544)
C1806-259 (NGC 6553)
C1807-317 (NGC 6558)
(38.154.038) - p.e. BV seq.

C1808-072 (IC 1276)
C1809-227 (Ter 12)
C1810-318 (NGC 6569)
(38.154.038) - p.e. BV seq.
C1812-121 (Kodaira 1)
C1814-522 (NGC 6584)
(40.154.013) - p.e. UBVRI seq. in field.
C1820-303 (NGC 6624, 4U/MXB 1820-30)
(40.142.067) - HEAO A-2 database searched for abs. events: 1 found in this cl.
(37.154.034) - photog. UV surf. phot.; search for UV-excess similar to that shown by NGC 7078 (M 15).
(41.142.035) - analysis of 6 X-ray bursts from cl.
C1821-249 (NGC 6626, M28)
(40.141.011) - X-ray source obs. at 30.9 and 50.5 MHz has sp. index -2.44; source is fast pulsar?
(40.154.033) - met. abund. and occurrence of Cepheids.
C1827-255 (NGC 6638)
C1828-235 (NGC 6642)
(38.154.038) - p.e. BV seq.
C1828-323 (NGC 6637, M69)
(38.154.082) - [Fe/H]-value from Washington phot. and echelle sp.
C1832-330 (NGC 6652)
(38.154.038) - p.e. BV seq.
C1833-239 (NGC 6656, M22)
(37.154.063) - photom. to cl. MS.
(42.154.019) - PM, photog. phot. for 672 st.; BV CMD.
(41.133.003) - IRAS 18333-2357: cooler than all OH/IR st., hotter than most gal.
(39.114.040) - est. sp. type of st. II-81 is O6; RV = $-140 kms^{-1}$.
(42.154.031) - central depths for CH- and CN-features and prominent abs. lines of Fe I, Ca I, Sr II, Ba II, and H for 23 RG st.
(41.154.064) - RV and vel. disp.
C1838-198 (Pal 8)
C1840-323 (NGC 6681, M70)
(39.154.001) - low-disp. IUE sp of UV-br. st. (38.154.023) - low-disp. IUE sp. of cl. nucleus.
(37.154.034) - photog. UV surf. phot.; search for UV-excess similar to that shown by NGC 7078 (M 15).
C1846-652 (NGC 6684)
C1850-087 (NGC 6712)
(39.154.023) - IR phot. for 15 RG st., incl. 5 var.
C1851-305 (NGC 6715, M54)
(38.154.023) - low-disp. IUE sp. of cl. nucleus.
C1852-227 (NGC 6717)
(38.154.038) - p.e. BV seq.
C1856-367 (NGC 6723)
(42.154.024) - Washington phot.; temp., abund., memb.
(38.154.011) - RG st. sp. comp. to NGC 104 (47 Tuc) RG st.
(42.154.031) - central depths for CH- and CN-features and prominent abs. lines of Fe I, Ca I, Sr II, Ba II, and H for 2 RG st.
(41.154.004) - BV and DDO p.e. phot.; radial color gradients.
(42.154.023) - DDO phot. of RG st.
C1902+017 (NGC 6749)
C1906-600 (NGC 6752)
(39.154.001) - low-disp. IUE sp. of UV-br. st.
(38.154.043) - cl. CMD shows gap in subgt. branch; interp., modif. to theory.
(38.154.034) - SIT Vidicon sp. of 26 st. over $\Delta m = 5$: from tip of RGB to MS turnoff.
(37.036.143) - CCD BV CMD. (41.154.006) - CCD BV CMD to MS.
(42.154.015) - photog. image reconstruction techniques of 5000+ st.; BV CMD.
(37.154.054) - optical and UV spectr. of BHB st. (41.154.011) - more optical and UV spectr. of BHB st.
(42.154.029) - two HB st. with strong He-lines (λ4026).
(42.154.018) - high-disp. sp. comp. to Arcturus for [Fe/H].
(37.154.066) - BV CMD. (42.114.001) - 9 HB st., $9.3 \leq T(3)_{eff} \leq 40.0°K$.
(38.154.024) - Walraven (VBLUW) phot. of RG st.; [Fe/H]-values determined.

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(41.154.063) - CCD BV CMD.
(39.154.064) - are cl. properties due to SN enrichment?
C1908+009 (NGC 6760)
C1914+300 (NGC 6779, M56)
(41.154.034) - spatial structure as function of limiting mag. of st. cts.
C1914-347 (Ter 7)
C1916+184 (Pal 10)
C1925-304 (Arp 2)
C1936-310 (NGC 6809, M55)
(42.154.024) - Washington phot.; temp., abund., memb.
(37.154.006) - automated star cts. (37.154.064) - electronogr. and CCD photom.
(38.154.078) - c.c. from echelle sp. of five RG st.
C1938-341 (Ter 8)
C1942-081 (Pal 11)
C1951+186 (NGC 6838, M71)
(41.153.034) - $< \Delta Fe >$ defined and meas. for individual st.
(40.154.036) - IR obs. of CO-band of 21 RG st.; comp. to 2 open cl. [NGC 2158 and 2682 (M 67)].
(39.154.003) - photom., PM for 350+ st. with $V < 16$; BV CMD.
(38.154.082) - [Fe/H]-value from Washington phot. and echelle sp.
(42.154.024) - Washington phot.; temp., abund., memb.
(42.154.018) - high-disp. sp. comp. to Arcturus for [Fe/H].
(37.131.148, 38.131.001) - I/S red. in direction of cl.; Vilnius p.e. system.
(41.154.064) - RV and vel. disp.
C2003-220 (NGC 6864, M75)
C2031+072 (NGC 6934)
(41.154.055) - sp. of RG st. interp. by mixing hypoth.
C2033-048 (NGC 6941)
C2050-127 (NGC 6981, M72)
C2059+160 (NGC 7006)
(40.154.019) - BV CMD to fainter than MS turnoff.
C2127+119 (NGC 7078, M15)
(37.134.018) - IUE obs. of PN, K648; central st. T_{eff}; mass loss est. from C IV abs. feature.
(39.154.001) - low-disp. IUE sp of UV-br. st. (39.154.054) - high spatial resol. of cl. core.
(38.142.021) - optical candidate (Auriere-Cordoni Catalog No.211) for cl. X-ray xource.
(40.154.007) - photog. phot. of BHB using GALAXY; 300 st.
(38.154.016) - computed synthetic sp. comp. to low-disp. sp. obs.
(39.154.009) - photog. phot.; BV CMD.
(38.114.069) - IUE sp. of st. ROA 5701; T_{eff} and M_{bol}.
(38.154.022) - self-consistent age determination from a variety of techniques.
(40.154.051) - CO and CN band str. among RG st. (38.154.021) - low-disp. IUE sp. of UV-br. st.
(39.154.073) - CCD UBV CMD; red., m-M, LF determined.
(39.154.032; Engl. transl.: 40.154.049) - scanner obs. of HB st. (I-70).
(38.154.024) - Walraven (VBLUW) phot. of RG st.; [Fe/H]-values determined.
(38.154.017) - PM used to determine cl. mass. (40.154.052) - C and N abund. among RG st.
(37.154.062) - CCD-derived CMD; isochrones.
(40.154.014) - theo. isochrone fits to cl. with UBVRI and Strömgren p.e. phot.
C2130-010 (NGC 7089, M2)
(39.154.001) - low-disp. IUE sp. of UV-br. st. (37.154.051) - PM for var. and other unusual st.
(38.154.016) - computed synthetic sp. comp. to low-disp. sp. obs.
(41.154.051) - RV of 69 st.; internal cl. dynamics.
C2137-234 (NGC 7099, M30)
(37.154.063) - photom. to cl. MS. (39.154.001) - low-disp. IUE sp of UV-br. st.
(39.154.054) - high spatial resol. of cl. core. (38.154.023) - low-disp. IUE sp. of cl. nucleus.
(38.154.058) - BV CMD.
(37.154.034) - photog. UV surf. phot.; search for UV-excess similar to that shown by NGC 7078 (M 15).
(41.154.004) - BV and DDO p.e. phot.; radial color gradients.
C2143-214 (Pal 12)
(38.154.016) - computed synthetic sp. comp. to low-disp. sp. obs.
C2304+124 (Pal 13)

(39.154.005) - BV CMD to upper MS; 122 st.
C2305-159 (NGC 7492)
C2346-732 (AM 3)

CLUSTER SYSTEMS

LMC clusters (see also 'Combined Studies' below)
(37.156.013, 42.154.053) - BVRI phot. of cl. in Bok Region: **NGC 1847, 1850, 1854,** and **1856** are most conspicuous.
(37.154.009, 38.154.055) - electronogr. photom. BV CMD of **Hodge 11 (= SL 868).**
(41.156.004) - electronogr. photom. BV CMD of **NGC 2210.**
(37.036.143) - CCD BV CMD of **Hodge 11 (= SL 868).**
(37.156.097, 38.154.068) - IUE integr. sp. of 17 cl.
(40.154.021) - CCD BV CMD for **NGC 2213** to MS turnoff; age.
(40.156.027) - LF for cl. br. than $M_B = -4.5$. (40.156.042) - integr. UBV colors; empirical age calib.
(39.154.011) - lum. profiles for **NGC 1835, 2210,** and **2257**; M/L ratios.
(37.154.058, 37.156.083) - age estimates (all < 1 Gyr) using time-dep't of model RG st. interior lum. for **NGC 1783, 1868, 1978, 2121, 2209,** and **2231.**
(37.156.007) - prelim. results of SIT surf. phot. of LMC cl.: UBV and RGU phot. for **NGC 1806** (red cl.) and **NGC 1818** (blue cl.)
(37.154.013) - SIT Vidicon BV photom. and CMD for **NGC 1466, 2203, 2210,** and **2257.**
(37.156.012) - CCD and SIT BV CMD for **NGC 1466, 2203, 2210,** and **2257; H11; LW 4.**
(38.154.079) - BV CMD of **NGC 1831,** to V = 21.5.
(37.154.017) - br., bl., rich cl. **NGC 1856** age est. from MS-turnoff to be $80(\pm 30) Myr$.
(37.154.029) - BV CMD of **NGC 2133** and **2134.** (41.156.038) - st. cts. for tidal radii and masses.
(37.156.082) - sp. obs. of 16 O-rich AGB st. (41.156.021) - CCD UBVR CMD of **Hodge 4.**
(41.154.036) - phot. to MS turnoff, age estimate of **NGC 1651.**
(42.154.028) - age of **NGC 2173** est. to be $1.8 \pm 0.7 Gyr$.
(37.154.010) - CCD BV CMD to V = 23.5 of **Hodge 11 (= SL 868).**
(38.154.061) - CCD BV CMD of **NGC 2210,** to V = 21.5.
SMC clusters (see also 'Combined Studies' below)
(38.154.043) - **Kron 3** CMD shows gap in subgt. branch; interp., modif. to theory.
(41.156.013) - C st. candidates in **NGC 419.** (40.156.002) - phot., sp. of **NGC 330** st.
(41.154.048) - BV CMD below MS turnoff and age est. for **NGC 411.**
(42.156.007) - finder charts and sp. class for br. st. in 15 cl.
(37.156.095, 39.154.024) - ellipticities of 24 cl. using BV isodensity contours.
(41.156.011, 41.156.037) - Schmidt obj. prism sp. class. for st. br. than B about 18.5.
(41.156.039) - st. cts. in 25 disk, 3 intermed., and 18 halo cl.
(41.156.040) - sp. class of br. st. in **NGC 1806, 1818, 1831, 2098,** and **2157.**
(42.156.007) - finder charts and sp. class for br. st. in 17 cl.
(37.156.093) - BV CMD of 20 cl.; Schmidt photog. phot.
(37.156.093) - LF for 10 old cl.
(37.154.059) - LF of **NGC 152** and of **Kron 3** in B and V.
(42.156.006) - st. cts. in 24 cl.; masses, concentration parameter.
(42.156.026) - CCD BV CMD of cl. **ESO121-SC03;** aperture phot.
(37.154.052) - depending on SMC dist. mod., age of cl. **Lindsay 113** is 4 or 5 Gyr; est. [m/H]= -1.4.
(37.154.011, 38.154.076) - BV CMD to MS of **Kron 3.**
(42.114.054) - supergt. A7 st. has metal. < field gt. st. in SMC.
(40.154.032) - MS isochrone fits to BV CMD for **NGC 121.**
Combined Studies of LMC and SMC
(40.156.039, 41.156.007) -integr. G-band and Hb phot. for 41 LMC and 10 SMC cl.
(37.156.017) - separating field st. contrib. from IUE sp. of LMC cl. **NGC 1786** and SMC cl. **NGC 121** and **330.**
(37.156.015) - IUE results summarized.
(39.156.025) - linear correlation for ellip. vs. mass of disk cl.
Fornax Group (of galaxies)
(42.157.095) - MMT-plus-echelle RV for cl. 3, 4, 5; systemic $RV = 55 \pm 5 kms^{-1}$.
(42.157.156) - cl. population found around five ell. gal. (NGC 1374, 1379, 1387, 1399, and1404).
Sculptor Group (of galaxies)

(40.157.035) - two cl. candidates in A0142-43.
NGC 147
(38.154.072) - integr. IR phot. of cl.
NGC 185
(38.154.072) - integr. IR phot. of cl.
NGC 205
(38.154.072) - integr. IR phot. of cl.
NGC 224 (M 31)
(39.157.067) - slitless sp.: 109 new cl. candidates.
(39.157.057) - cl. used as probes of I/S medium in gal.; obtain $E_{U-B}/E_{B-V} = 1.01 \pm 0.11$; confirm NW side is near side.
(38.154.053) - flattening and lum. profile of Mayall II.
(37.154.036; Engl. transl.: 38.154.045) - cl. show metal. gradient radially outward from center of gal.
(40.154.005; Engl. transl.: 41.154.025) - integr. p.e. UBV obs. of 53 cl.
(38.154.015) - p.e. UBV phot. of 21 cl. (38.154.072) - integr. IR phot. of cl.
(37.154.037; Engl. transl.: 38.154.019) - ellipticities and maj. axis orientations of 5 cl.
(40.154.055; Engl. transl.: 42.154.007) - ellipticities and orientation of 30 cl.
(39.157.088) - statistically significant excess of br. images in lum. range for cl.
NGC 253
(41.157.006) - search for cl. candidates: of 25, 3 are bl ., 4 are redder than Gal. cl.; est. $N_{tot} = 80 \pm 42$ cl.
NGC 524
(39.157.119) - st. cts.; cl. system more populous and more extended than in NGC 1052.
NGC 598 (M 33)
(37.157.226) - 4 true cl., all more m.-p. than 47 Tuc (NGC 104).
NGC 1052
(39.157.119) - st. cts.; cl. system less populous and less extended than in NGC 524.
NGC 1705
(40.157.038) - super st. cl.: integr. $M_B = -15.4$, <Sp. Type> = B3 V.
NGC 2403
(37.154.001) - find 19 obj. br. than V = 20 which are cl. candidates.
NGC 2683
(40.157.132) - st. cts.; cl. system as populous as Galaxy's; from $N_{cl} = 100 \pm 31$ cl. obs. , est. $N_{tot} = 321 \pm 108$ cl.
NGC 3109
(40.157.035) - 6 cl. candidates: one positive.
NGC 3115
(41.157.190) - st. cts. reveal spatial distrib. of cl. population.
NGC 3379 (M 105)
(40.157.062) - $N_{tot} = 140 \pm 35$ cl.; peak lum. of cl. distrib. may be 'standard candle'.
NGC 3557
(39.157.059) - cl. population is sparse.
NGC 4486 (M 87)
(41.158.280) - CCD obs. of gal. core; distrib. of cl. br. than B = 24.4; no systematic radial trend in cl. LF.
(41.154.002) - [Fe/H]-values for 5 cl. (41.158.195) - 124 cl., B < 23.6, from CCD obs.
(39.158.082) - LF for cl. to B = 25.4; est. $N_{tot} = 2 \times 10^4$ cl.
NGC 4594 ('The Sombrero')
(37.154.018) - st. cts. reveal 1200(±100) cl. to $V_{lim} \approx 23.1$ and 515(±100) cl. to U_{lim} about 23.
NGC 5128 (Centaurus A)
(37.158.105) - IR obs. of 12 cl.; 5 are more m.-r. than Sun, and quite lum.
(38.158.270) - est. $1200 \leq N_{cl} \leq 1900$ from UVR st. cts.
(38.158.271) - dist. of cl. is typical for ell. gal. (37.158.041) - sp. confirmation of 20 cl.

7 .Dynamical theory

Over the last three years the dynamical theory of star clusters and associations has been dominated by research into the evolution of globular clusters, especially the role played by tidal binaries in the phase after collapse of the core. It is some measure of the progress made that these topics occupy only a

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small part of the volume of proceedings of IAU Symposium 113 (39.012.070), which was devoted to the dynamics of star clusters. And yet important progress has been made in other areas too. The modelling of open clusters is now almost as realistic as it can be, and at last a respectable amount of attention is being paid to the dynamics of very young clusters. The theory of the stability of stellar systems is another area which has produced interesting new results in the last three years, though it still remains to integrate this field properly with the theory of dynamical evolution.

We begin with general developments of theory, i.e. those with no specific application in view. In view of its fundamental importance, it is surprising how much discussion there has been about the basic timescale for the dynamical evolution of collisional systems (37.151.044, 39.151.098, 39.151.121, 41.151.043, 42.151.040). New formulations have been proposed for a kinetic equation to describe collisonal relaxation (39.151.114, 90.88554), and for the virial theorem (40.151.059; see also 38.151.058 and 40.151.069 for applications of the standard virial theorem). New studies of the role played by violent relaxation (38.151.002, 39.151.143, 40.151.001, 41.151.065) have been supplemented by work on entropy and its analogues (41.151.027, 90.88546). Another interesting paper describes a modification of the Holtsmark distribution at small separations (42.042.002). Finally, it is very useful to have a new general introduction to a wide range of problems in stellar dynamics (40.003.011).

As was mentioned above, developments in the theory of stability have been a feature of the review period. One publication, however, goes back much further; this is an English translation of Antonov's classic 1962 paper on the thermodynamic stability of isothermal clusters (39.151.133; see also 40.151.022 on this topic). Another important but newer translation is that of the very comprehensive study by Fridman and Polyachenko (38.003.008, 009). Some of the new research has sought to clarify the role of anisotropy in generating dynamical instabilities (39.151.111, 40.151.086, 41.151.002, 90.66683), but there have been interesting developments also in the study of isotropic systems (38.151.045, 39.151.070, 39.151.095, 40.151.074, 42.151.051,079), multi-component systems (39.151.019, 42.151.025), and those exhibiting rotation (90.101933).

One of the traditional tasks of theory is the construction of models for the interpretation of observations. In view of the long history of this topic, the development which it has undergone in the last three years is remarkable. Among the simplest models are those with a phase-space cutoff (37.154.041, 90.72556), as in King's models, of which a useful set of tables has been published (41.151.097). Recent work has added greatly to our knowledge of analytic anisotropic models (37.151.042, 39.151.096, 40.151.008, 41.151.112, 90.55741), and new models have been described for multi-component systems (39.151.115) and for slowly rotating ones (39.151.118, 42.151.034, 90.101865). Developments in the solution of Poisson's equation in three dimensions may be useful for this purpose (41.151.051). The possibility of contructing models with discontinuous distribution functions has also been raised (39.151.142, 40.151.039).

Let us turn now to the dynamical evolution of stellar systems, and especially to young systems such as newly formed open clusters, which have not yet reached dynamical equilibrium. Dynamical aspects of their formation have been discussed several times recently (38.151.048, 39.151.130, 41.131.082, 41.154.021). If the loss of gas pressure on star formation leads to a collapse of the protocluster, this collapse will be unstable (37.151.052, 41.151.069, 42.151.059). Models have been constructed for non-equilibrium clusters (40.151.046, 40.151.106, 41.151.079), and other studies on such systems have concentrated on mechanisms of relaxation (40.151.045,.107) and stellar escape (40.153.011, 41.153.024). Other studies relevant to the dynamical theory of young clusters which have also appeared in the review period are 39.118.027, 40.151.009 and 42.153.003. The first two deal with dynamically isolated subgroups of stars, and the third is a review, including associations.

Open clusters have continued to attract theoretical attention, and reviews of different aspects of their dynamics can be found in the proceedings of IAU Symposium No.113 (39.151.129, 39.153.045), along with a translation of one of Ambartsumian's classic papers on the subject (39.151.132). A considerable amount of work has been devoted to their interaction with their environment, with regard to tidal effects (40.151.044,070, 41.151.067, 42.151.084) and also capture of field stars (41.153.012). Other studies have dealt with the motion of open clusters, relative to each other (41.153.019) and within the Galaxy (41.153.028).

The computer simulation of open clusters has now reached a remarkable level of realism (90.55748), and somewhat more idealised simulations have clarified our understanding of the role of hard binaries (39.151.039,116, 40.151.094), relaxation (39.151.113), and the measurement of core parameters (40.151.-077, 42.151.052). In a sense, then, the simulation of open clusters is now a manageable problem, essentially because open clusters are so small. But attempts have been made to interpret results from small simulations in the context of globular clusters (41.151.007, 42.151.107,.108). As yet, however, the only simulations which can really handle such large systems are fluid ones (the validity of which is studied in

39.151.001) or else hybrids which deal with the innermost parts by means of direct N-body simulation (38.042.083, 38.151.034,.035, 39.151.109). The present state of the art has been reviewed in detail recently (39.151.108, 42.151.078), but there are many promising ideas for extending the size of simulated N-body systems to that of a small globular cluster (39.042.026,.088, 39.151.110, and the book *The Use of Supercomputers in Stellar Dynamics*, eds. P. Hut & S. McMillan, Springer-Verlag, 1986). One of the problems is the handling of small subsystems, and a convenient treatment of these is now available (40.042.013).

Most of the work on globular clusters during the review period has made use of simplified models for their dynamical evolution, such as the Fokker-Planck equation (39.151.102), and not of N-body methods. Introductory articles will be found in 38.151.013, 39.154.046 and 41.154.035, and a simple article on stellar orbits in globular clusters is given in 38.151.046. The early evolution is dominated by core collapse (37.151.098, 39.151.100), and it is very useful now to have some results on the collapse of systems started as lowered Maxwellian models (40.151.093), since these are popular models for the interpretation of globular clusters. To say that core collapse is now understood obscures the fact that this is true only for idealised models. For example we know little of the effect of rotation (38.151.050, 42.151.021). On the other hand good progress has been made in understanding the effects of mass-loss by stellar evolution (41.151.029), close encounters (39.151.103), anisotropy (39.151.112, 41.151.072,.119), and, most notably, a mass spectrum (37.151.057,.103, 38.151.091,.094, 39.151.038,.077,.104, 40.151.010, 41.151.108, 42.151.114). Consult these papers if you want to construct a multi-mass model and are tempted to assume equipartition.

During the last three years there has been a steady increase in the attention paid to what happens after core collapse, since some clusters should be old enough dynamically (37.154.033). Several methods have been used for these studies, including Monte Carlo simulation (39.151.124, 41.154.061), fluid models (37.151.009,.085, 38.151.095, 39.151.101), a hybrid model (39.151.119, 42.151.028) and even a simplified homological model (39.151.168). One of the surprises of these studies was the discovery of gravothermal oscillations after core collapse; the nature of these is still under investigation (37.151.074, 39.151.105,.106, 39.154.087, 90.101859).

In these studies of post-collapse evolution the role played by binary stars is crucial, and there has been an explosion of interest in their dynamics. We now have predictions for their rate of formation both by three-body interactions (39.151.107) and by tidal two-body encounters, using reasonably realistic stellar models (37.154.016, 39.151.127, 40.151.057,.073, 41.151.109, 42.117.227, 42.151.038,.101). Having formed, the binaries evolve by interactions with each other (39.151.120, 42.042.043, 42.151.113) or with single stars (38.154.025,.026, 39.117.310,.311, 42.151.103). For interactions with tidally formed binaries it is important to take into account their finite sizes (38.117.205, 40.151.088, 42.154.005). For this reason, and because of the estimated rate of collisions between single stars in globular clusters, attention has been turned to the description and numerical simulation of this phenomenon (39.151.041,.042, 41.154.040, 42.151.068, 42.154.004). The importance of all these processes for the dynamics of the cluster itself is implicit in most of the papers referred to above on post-collapse evolution, and is also specifically addressed in 37.154.004, 39.151.123,.091 and 41.151.039.

In the last three years relatively little work has been done on the once fashionable area of cluster dynamics in the presence of a black hole (37.154.003, 39.067.103, 39.151.125,.126, 90.115529), though small black holes may be a significant constituent of some clusters (38.154.027, 39.154.067).

Finally we turn to the theory of the system of Galactic globular clusters. A little new work has been done on their orbits (38.154.013, 39.154.066, 41.151.048), but much more on their stability against tidal disruption. Some of this concerns details of the effects of tides on an individual cluster (37.154.008, 39.151.122,.128), but other investigations have concentrated on the dependence of tidal effects on galactocentric distance (37.154.007, 38.151.025, 38.154.044), or their influence on cluster lifetimes (39.154.033) and internal evolution (42.151.080).

Very little work has been done on the dynamical theory of cluster systems in other galaxies, except for the interesting phenomenon of cluster exchange between members of a cluster of galaxies (38.160.046, 41.151.028,42.151.003, 90.101943). This has been an area of intense activity recently on the observational side, and it is to be hoped that this will be matched by an appropriate effort on the theoretical side in the coming years. Another probable growth area may well be improvements in the modelling of tidal interactions and collisions and their influence on the internal evolution of individual globular clusters. But it is to be hoped that more will be done to provide more realistic models for globular clusters. We still use models developed in the 1960s, and much progress has been made in the understanding of the dynamical evolution of clusters since then. These developments should be incorporated in the models we use now.