
NASA
Globular Clusters
Stellar Pockets

1
00:00:19,790 --> 00:00:18,410
fabula cluster is a big sphere of stars

2
00:00:22,310 --> 00:00:19,800
that have collected together they're

3
00:00:24,710 --> 00:00:22,320
orbiting around a Common Center but it's

4
00:00:26,870 --> 00:00:24,720
very spherical very organized looks like

5
00:00:29,509 --> 00:00:26,880
a huge basketball contains hundreds of

6
00:00:32,150 --> 00:00:29,519
thousands of stars these clusters have

7
00:00:35,030 --> 00:00:32,160
formed early on in the formation of a

8
00:00:38,090 --> 00:00:35,040
galaxy when the cluster starts farming

9
00:00:40,549 --> 00:00:38,100
it's a very diffuse and over time things

10
00:00:41,950 --> 00:00:40,559
get concentrated more and more toward

11
00:00:44,209 --> 00:00:41,960
the center

12
00:00:45,709 --> 00:00:44,219
stars are actually moving all around and

13
00:00:48,049 --> 00:00:45,719

if they're sort of orbiting around the

14
00:00:49,490 --> 00:00:48,059
center it's not a static cluster even

15
00:00:53,150 --> 00:00:49,500
though a single picture makes everything

16
00:00:58,010 --> 00:00:55,610
one of the more famous ones is Messier

17
00:01:00,889 --> 00:00:58,020
13.

18
00:01:03,290 --> 00:01:00,899
Omega Centauri is a prototypical one in

19
00:01:05,870 --> 00:01:03,300
the southern hemisphere

20
00:01:07,789 --> 00:01:05,880
globular clusters are very old there

21
00:01:10,490 --> 00:01:07,799
seem to be some of the first stars

22
00:01:13,250 --> 00:01:10,500
formed in the Galaxy as the material

23
00:01:15,950 --> 00:01:13,260
that came together in the past one of

24
00:01:17,630 --> 00:01:15,960
the pockets of condensed material that

25
00:01:20,390 --> 00:01:17,640
occurred around the center of the Galaxy

26
00:01:23,210 --> 00:01:20,400
grew together into the selections of

27
00:01:26,210 --> 00:01:23,220
stars so they're mostly very old SARS 10

28
00:01:29,570 --> 00:01:26,220
or 12 billion years old although we do

29
00:01:32,690 --> 00:01:29,580
see a second generation of newer younger

30
00:01:34,310 --> 00:01:32,700
stars in globular clusters still you

31
00:01:37,190 --> 00:01:34,320
know relatively old billions of years

32
00:01:39,350 --> 00:01:37,200
ago but it's not like it had one burst

33
00:01:41,090 --> 00:01:39,360
of star formation and that was it we did

34
00:01:43,130 --> 00:01:41,100
have a chance to form a second wave

35
00:01:45,830 --> 00:01:43,140
later on

36
00:01:47,810 --> 00:01:45,840
was still in one is what's called an

37
00:01:50,030 --> 00:01:47,820
open cluster it's a very loose

38
00:01:53,330 --> 00:01:50,040

collection of stars over a broad area

39
00:01:56,090 --> 00:01:53,340
it's more sort of a cloud of stars as

40
00:01:57,889 --> 00:01:56,100
more stars gather in an open cluster

41
00:02:00,050 --> 00:01:57,899
like that and more material comes

42
00:02:02,149 --> 00:02:00,060
together it's going to naturally pull

43
00:02:05,090 --> 00:02:02,159
things in toward its Center something

44
00:02:08,089 --> 00:02:05,100
like Western over many millions of years

45
00:02:10,609 --> 00:02:08,099
could evolve into something that looks

46
00:02:12,530 --> 00:02:10,619
more like a globular and we do think

47
00:02:15,170 --> 00:02:12,540
that most globulars have one or more

48
00:02:17,690 --> 00:02:15,180
black holes at the center which is a

49
00:02:20,750 --> 00:02:17,700
source of immense gravity to help hold

50
00:02:24,830 --> 00:02:20,760
these clusters together Hubble saw in

51
00:02:27,170 --> 00:02:24,840
the globular cluster NGC 6397 the first

52
00:02:29,630 --> 00:02:27,180
clear evidence for multiple black holes

53
00:02:31,490 --> 00:02:29,640
at the center we had previously assumed

54
00:02:34,010 --> 00:02:31,500
that most globulars would have a single

55
00:02:36,830 --> 00:02:34,020
black hole at the center in this case we

56
00:02:38,510 --> 00:02:36,840
found a number of separate black holes

57
00:02:41,030 --> 00:02:38,520
they're moving around each other at high

58
00:02:44,210 --> 00:02:41,040
speeds around a Common Center

59
00:02:45,710 --> 00:02:44,220
if you have a number of black holes in

60
00:02:47,630 --> 00:02:45,720
tight orbits around each other at the

61
00:02:49,309 --> 00:02:47,640
center that works as well as a single