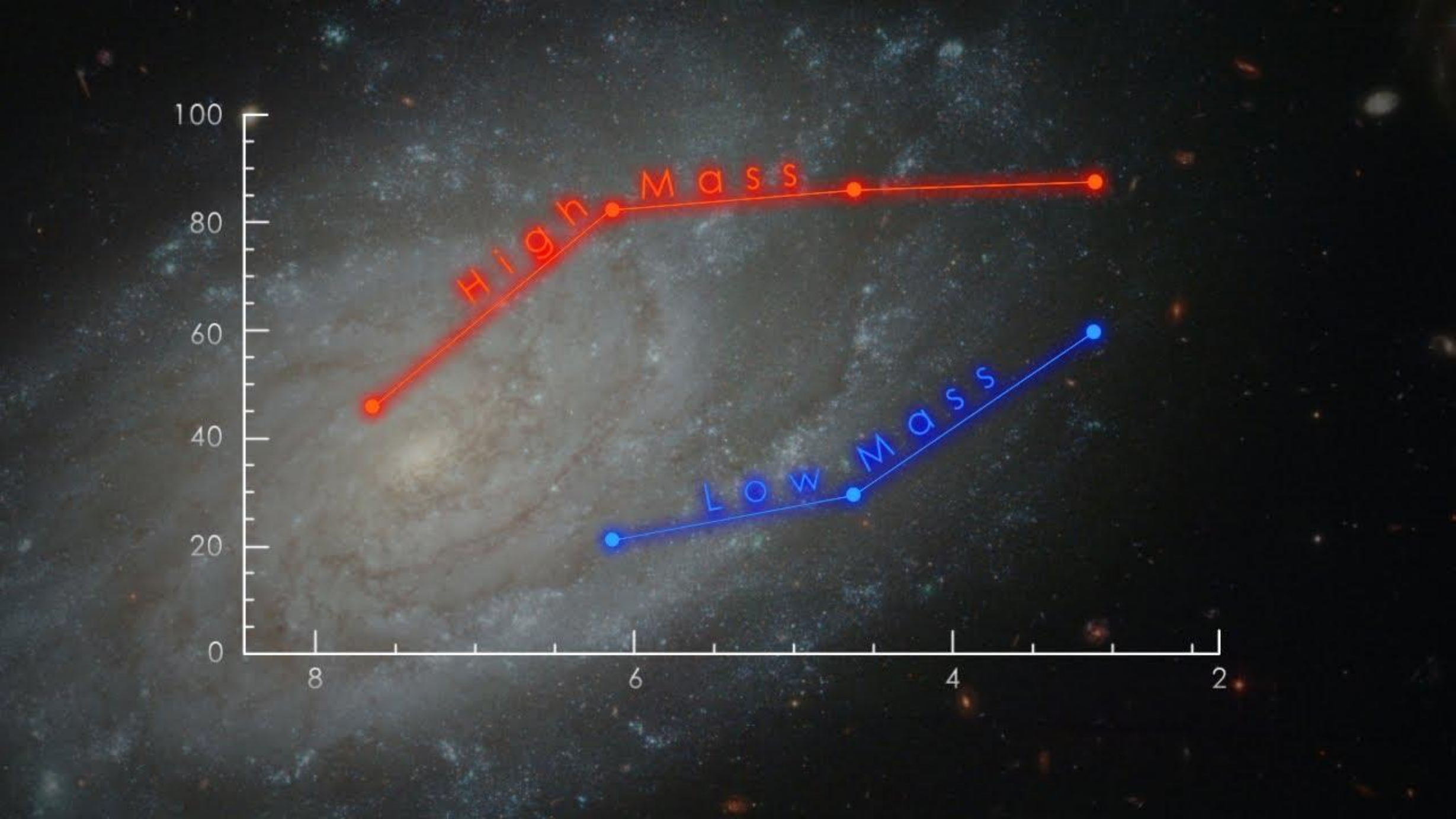
100
80
60
40
20
0
8
6
4
2
High Mass
Low Mass

1
00:00:12,080 --> 00:00:08,050
Music

2
00:00:12,100 --> 00:00:16,090
Narrator: When we picture a galaxy, we tend to imagine a tranquil

3
00:00:16,110 --> 00:00:20,130
pinwheel of stars, spinning in the cosmic night.

4
00:00:20,150 --> 00:00:24,160
Astronomers imagined something similar, that disk galaxies, like our own Milky Way,

5
00:00:24,180 --> 00:00:28,190
had reached their present states billions of years ago.

6
00:00:28,210 --> 00:00:32,250
Now, a study led by Susan Kassin at NASA Goddard, has turned this thinking

7
00:00:32,270 --> 00:00:36,290
on its head. Susan: We find that disk-like galaxies

8
00:00:36,310 --> 00:00:40,370
become progressively more ordered with time. This was a surprise to people in the field

9
00:00:40,390 --> 00:00:44,410
because we thought that galaxies already 8 billion years ago were gonna

10
00:00:44,430 --> 00:00:48,450
be very much like galaxies today, whereas that's really not the case.

11
00:00:48,470 --> 00:00:52,480
Over this period of time galaxies spin faster, the

12
00:00:52,500 --> 00:00:56,520
amount of disordered motions that they harbor has decreased, and their

13
00:00:56,540 --> 00:01:00,560

total energies increase. Narrator: Over the past 8 billion years

14
00:01:00,580 --> 00:01:04,590
disk galaxies began as train wrecks and then evolved into the orderly

15
00:01:04,620 --> 00:01:08,650
systems we see nearby today. Susan: We found out how fast

16
00:01:08,670 --> 00:01:12,700
they were rotating and how much disordered motions they have from

17
00:01:12,720 --> 00:01:16,770
spectra from the Keck telescopes. And then in order to interpret the rotation

18
00:01:16,790 --> 00:01:20,840
measurements we needed images from the Hubble Space Telescope to tell us how the

19
00:01:20,860 --> 00:01:24,860
galaxies were oriented.

20
00:01:24,880 --> 00:01:28,890
So we find the mass of a galaxy plays a large role in how organized it is.

21
00:01:28,910 --> 00:01:32,960
The most massive galaxies are the most well organized at all times, and

22
00:01:32,980 --> 00:01:36,980
the least massive galaxies are the least well organized at all times.

23
00:01:37,000 --> 00:01:41,010
So on average, the percentage of galaxies which are settled increases

24
00:01:41,030 --> 00:01:45,030
with time. Here you're seeing it for the

25
00:01:45,050 --> 00:01:49,060
higher mass systems. It's also

26
00:01:49,080 --> 00:01:53,090
the case for the lower mass systems. The percentage of galaxies

27
00:01:53,110 --> 00:01:57,140
which are settled just increases with time, but the overall

28
00:01:57,160 --> 00:02:01,160
percentages for the lower mass systems are always lower than the higher mass systems.

29
00:02:01,180 --> 00:02:05,190
We've yet to figure our why this is.

30
00:02:05,210 --> 00:02:09,220
In our models of how galaxies evolve, we find that galaxies are

31
00:02:09,240 --> 00:02:13,260
possibly more disordered in the past because they're bombarded with more material.

32
00:02:13,280 --> 00:02:17,370
There are more small galaxies that accrete onto it, there are more major

33
00:02:17,390 --> 00:02:21,410
mergers of galaxies and there's more accretion of gas.

34
00:02:21,430 --> 00:02:25,450
From our models we expect that this constant bombardment should slow down with time.

35
00:02:25,480 --> 00:02:29,490
And this might be why we're finding this in the observations.

36
00:02:29,510 --> 00:02:33,600
And what we're finding might also be due to a decreasing amount of

37
00:02:33,620 --> 00:02:37,620
supernovae with time. However, the simulations as they are

38
00:02:37,640 --> 00:02:41,650

now are really only at the stage where they're giving us clues as to what's going on.

39
00:02:41,670 --> 00:02:45,680
In order to get the detailed measurements to really find out what's going on, we're going

40
00:02:45,700 --> 00:02:49,710
to need the James Webb Space Telescope.

41
00:02:49,730 --> 00:02:53,730
Narrator: This new picture tells us that disk galaxies like our own Milky Way

42
00:02:53,750 --> 00:02:57,760
experienced a rowdy past for a much longer time than previously imagined.

43
00:02:57,780 --> 00:03:01,790
A period that includes the formation of the solar system and the origin of life on

44
00:03:01,810 --> 00:03:05,820
Earth. (Music)