

WEBVTT

1

00:00:23.730 --> 00:00:24.480

Sarah Jeffreson: As

2

00:00:25.590 --> 00:00:28.080

Sarah Jeffreson: Well as a style.

3

00:00:29.520 --> 00:00:40.860

Sarah Jeffreson: Called few patients sampled stochastic we from the I, the IMF and also the chemistry of the install media.

4

00:00:44.250 --> 00:00:50.220

Sarah Jeffreson: Using the applied external gravitational

5

00:00:51.300 --> 00:01:05.970

Sarah Jeffreson: Potential I've adjusted the scale hides and the circular velocities of the discs in order to probe is larger range of galactic dynamical and

6

00:01:07.020 --> 00:01:13.620

Sarah Jeffreson: Prior moments as I can. And these can be

7

00:01:14.970 --> 00:01:46.050

Sarah Jeffreson: Parameter fries in terms of the Galactic Shia parameter on the x axis here the gravitational stability on the Y axis and the orbital. And you'll see it will last city given by the collar ball and were able to spend around an order of magnitude. And each of these. So each square in

8

00:01:48.030 --> 00:01:51.360

Sarah Jeffreson: The parameter space represents and

9

00:01:52.380 --> 00:02:06.870

Sarah Jeffreson: As the mercifully averaged population of clouds alone or radio true chick jury in each

10

00:02:08.670 --> 00:02:29.130

Sarah Jeffreson: In each of the discs. So now that we have this large population of clouds were able to examine how the physical properties correlate with the times.

11

00:02:30.180 --> 00:02:32.640

Sarah Jeffreson: And scales of the key galactic

12

00:02:33.960 --> 00:02:44.400

Sarah Jeffreson: Dynamical processes that operate and in our Milky Way, like

13

00:02:47.400 --> 00:02:54.360

Sarah Jeffreson: Galaxies we climb this. These are the

14

00:02:55.710 --> 00:03:00.630

Sarah Jeffreson: Time scale for galactic Shia in the open.

15

00:03:03.000 --> 00:03:11.040

Sarah Jeffreson: Graph here and then the gravitational bring full time scale in the solar panel.

16

00:03:12.540 --> 00:03:24.000

Sarah Jeffreson: And we can divide the parameter space, according to which of the two times girls as the shortest and is therefore expected to have the largest influence on how the clouds bubble

17

00:03:25.560 --> 00:03:36.930

Sarah Jeffreson: And so, for example, we find that the median aspect ratio of our clouds to the

18

00:03:38.490 --> 00:03:48.060

Sarah Jeffreson: Displays and environmental trend where it correlates with the sheer time scale in the sheer so on.

19

00:03:49.830 --> 00:03:55.020

Sarah Jeffreson: Now you should regime and then with the

20

00:03:57.660 --> 00:04:00.240

Sarah Jeffreson: Free pool.

21

00:04:01.890 --> 00:04:02.190

So,

22

00:04:03.360 --> 00:04:05.640

Sarah Jeffreson: Time scale in the

23

00:04:07.050 --> 00:04:08.100

Sarah Jeffreson: Gravity.

24

00:04:09.960 --> 00:04:25.860

Sarah Jeffreson: Dominated by machine. So in other words, as the influence of galactic rotation increases compared to gravity. The clouds is slightly stretched out along this direction and

25

00:04:26.550 --> 00:04:48.060

Sarah Jeffreson: We see the same trend again in the internal velocity and I stopped up of the clouds and all and also in their specific and angular momentum in the plane of the galaxy which also increases with the influence of cheering

26

00:04:49.410 --> 00:05:01.410

Sarah Jeffreson: However, we find that for the turbulence and staff forming properties. There is no

27

00:05:03.570 --> 00:05:06.000

Sarah Jeffreson: CLIA and vibe.

28

00:05:08.640 --> 00:05:09.360

Sarah Jeffreson: Mantle

29

00:05:11.340 --> 00:05:12.360

Sarah Jeffreson: Variation

30

00:05:13.530 --> 00:05:23.340

Sarah Jeffreson: Know, so we're able to summarize these results in terms of the significance of the

31

00:05:24.900 --> 00:05:42.900

Sarah Jeffreson: Correlation with the Galactic dynamical timescales were in the green region. Here we show this, the rotational properties of food clouds.

32

00:05:44.160 --> 00:05:50.040

Sarah Jeffreson: Do display a significant environmental trend, but in the red area that

33

00:05:51.090 --> 00:05:52.770

Sarah Jeffreson: The turbulent winds to start warming

34

00:05:53.820 --> 00:05:57.840

Sarah Jeffreson: Cloud properties are not

35

00:05:58.920 --> 00:06:07.740

Sarah Jeffreson: And actually, this would be expected because we also find that the clouds in our simulations are over.

36

00:06:09.120 --> 00:06:12.990

Sarah Jeffreson: 25 times the height. Just

37

00:06:15.000 --> 00:06:30.390

Sarah Jeffreson: Classic needs playing pressure and we actually would not be expect these to interact a lot with the environment, however, that that age one

38

00:06:31.650 --> 00:06:37.860

Sarah Jeffreson: Clouds and now simulations are only looking for

39

00:06:39.270 --> 00:06:40.380

Sarah Jeffreson: Times over

40

00:06:44.520 --> 00:06:49.350

Sarah Jeffreson: Pressured and here it is the rotational as well as

41

00:06:51.720 --> 00:06:52.620

Slowly

42

00:06:55.980 --> 00:06:59.280

Sarah Jeffreson: Turbulent properties. That's

43

00:07:00.990 --> 00:07:03.450

Sarah Jeffreson: displayed a correlation with the environment.

44

00:07:06.810 --> 00:07:09.390

Sarah Jeffreson: And this is just that may be in galaxies that have

45

00:07:10.680 --> 00:07:35.250

Sarah Jeffreson: High mass that on the molecular clouds will also be Europe slowly. He pressure to us and needs plane and so have a large galactic dynamical coupling.

46

00:07:36.510 --> 00:07:39.390

Sarah Jeffreson: So I've only talked so far.

47

00:07:45.060 --> 00:07:46.050

Sarah Jeffreson: About this

48

00:07:47.370 --> 00:07:48.180

Sarah Jeffreson: Chaotic

49

00:07:49.440 --> 00:07:50.400

Sarah Jeffreson: Property properties.

50

00:07:51.810 --> 00:07:58.050

Sarah Jeffreson: However, we're also able to track the clouds and the simulations over time in order to

51

00:07:59.520 --> 00:08:01.350

Sarah Jeffreson: Produce the

52

00:08:02.850 --> 00:08:04.650

Sarah Jeffreson: Cloud evolution.

53

00:08:06.570 --> 00:08:22.200

Sarah Jeffreson: At work here. So, here the time runs from the top to the bottom of the slide, and we can see where the mergers and the splits occur. And then we can look at cloud sim

54

00:08:29.220 --> 00:08:39.330

Sarah Jeffreson: Graphics, for example, comparing the clouds that do undergo interactions throughout their evolution for those that remains

55

00:08:41.010 --> 00:08:43.290

Sarah Jeffreson: Yet room and a nice

56

00:08:44.520 --> 00:08:49.620

Sarah Jeffreson: very timid throughout their lives and then to we see that

57

00:08:51.750 --> 00:08:55.920

Sarah Jeffreson: The clouds with do want to go interactions tend to have a higher mass

58

00:08:56.580 --> 00:08:57.630

Sarah Jeffreson: And level.

59

00:08:58.080 --> 00:08:58.950

Of

60

00:09:01.470 --> 00:09:03.990

Sarah Jeffreson: Tech turbulence and also

61

00:09:06.030 --> 00:09:07.620

Sarah Jeffreson: Staff form.

62

00:09:14.340 --> 00:09:24.780

Sarah Jeffreson: Right then, those that evolve in isolation. So we can go a step further and look only at the parts of the trajectories that occur after merger.

63

00:09:25.080 --> 00:09:37.560

Sarah Jeffreson: And here, although we see the emergence do increase the mass of the clouds. They only had a small influence on the level of star formation in the clouds that interact

64

00:09:39.480 --> 00:09:40.590

Sarah Jeffreson: So,

65

00:09:44.550 --> 00:09:56.100

Sarah Jeffreson: We can also calculate the average cloud lifetime from our evolution network and to

66

00:09:57.660 --> 00:10:03.900

Sarah Jeffreson: Just by looking at the network. We can see this should be a roughly exponential distribution as

67

00:10:05.070 --> 00:10:14.640

Sarah Jeffreson: The rights of cloud formation and destruction, a constant in time and the number of clouds is constant in time, which indicates here.

68

00:10:15.780 --> 00:10:19.980

Sarah Jeffreson: That the number of clouds, we expect to survive for at a time.

69

00:10:21.480 --> 00:10:23.730

Sarah Jeffreson: Longer than then

70

00:10:25.770 --> 00:10:32.610

Sarah Jeffreson: Then time t should be exponentially distributed. So if we then

71

00:10:33.630 --> 00:10:34.770

Sarah Jeffreson: Take your

72

00:10:38.430 --> 00:10:40.800

Sarah Jeffreson: Own cheap call flow.

73

00:10:48.630 --> 00:11:12.390

Sarah Jeffreson: Through the emerging history and in order to isolate the unique trajectories that correspond with this survival times of in individual clouds. We see this. Yes, indeed, the survival times exponentially distributed, which means they're able to get the average cloud life.

74

00:11:14.010 --> 00:11:17.880

Sarah Jeffreson: Time Out of the slope.

75

00:11:19.110 --> 00:11:22.470

Sarah Jeffreson: And if we actually do this with the clouds.

76

00:11:23.610 --> 00:11:55.680

Sarah Jeffreson: Of two fruits mass we say that there's a steep drop in the cloud lifetime as the mass increases and this can actually be understood in terms of the median evolution of the pressure and the SFO which show that smaller clouds tend to need a longer time to collapse.

77

00:11:57.960 --> 00:11:59.580

Sarah Jeffreson: To lodge.

78

00:12:00.690 --> 00:12:02.580

Sarah Jeffreson: Pressures and

79

00:12:03.600 --> 00:12:04.650

Sarah Jeffreson: pebbles have

80

00:12:08.850 --> 00:12:11.280

Sarah Jeffreson: No levels of

81

00:12:12.540 --> 00:12:15.660

Sarah Jeffreson: Pounds goodness in order to

82

00:12:17.010 --> 00:12:22.680

Sarah Jeffreson: Achieve the efficiency of star formation that's required to then disperse the cloud again.

83

00:12:23.880 --> 00:12:25.890

Sarah Jeffreson: And then

84

00:12:27.570 --> 00:12:32.340

Sarah Jeffreson: By degrading the resolution of the maps, we use to identify the clouds.

85

00:12:35.220 --> 00:12:41.730

Sarah Jeffreson: Were able to actually look at the scaling relation all the cloud lie.

86

00:12:43.440 --> 00:12:47.850

Sarah Jeffreson: Time. And here we see this. It's able

87

00:12:49.680 --> 00:12:53.850

Sarah Jeffreson: To be clearly divided into two regimes, so

88

00:12:55.170 --> 00:13:00.750

Sarah Jeffreson: If we're able to resolve scale height of the gas days were able to resolve the clouds.

89

00:13:02.640 --> 00:13:17.340

Sarah Jeffreson: Are actually three collapsing and and forming stars and being dispersed as we see that the load time increases as the size of the clouds gets smaller.

90

00:13:19.080 --> 00:13:23.250

Sarah Jeffreson: slippery however if where

91

00:13:25.320 --> 00:13:26.670

Sarah Jeffreson: we're unable

92

00:13:28.290 --> 00:13:33.900

Sarah Jeffreson: To resolve the scale hide we bind the lifetimes of the clouds just converge to

93

00:13:34.950 --> 00:13:35.970
Sarah Jeffreson: The city.

94
00:13:41.460 --> 00:13:44.130
Sarah Jeffreson: CAS t's.

95
00:13:45.180 --> 00:13:46.020
Sarah Jeffreson: Crossing.

96
00:13:47.970 --> 00:13:53.220
Sarah Jeffreson: Time and this is expected because the majority of objects we identified in

97
00:13:54.360 --> 00:13:57.210
Sarah Jeffreson: This case would be

98
00:13:58.800 --> 00:13:59.880
Sarah Jeffreson: Particularly

99
00:14:01.500 --> 00:14:27.120
Sarah Jeffreson: Confined on the scale. I did the disk. So, um, yeah. I think I'm out of time, but, in conclusion, we find that the stopping properties of our clouds do not depend on the environment, although those of the H1 slowly clouds as low over

100
00:14:34.140 --> 00:14:35.010
Sarah Jeffreson: Crushes

101
00:14:36.930 --> 00:14:38.340
Sarah Jeffreson: Do depend on the environment.

102
00:14:39.450 --> 00:14:49.200
Sarah Jeffreson: Then we find that the molecular clouds that interact more massive in turbulence and with smaller levels of star formation than those that do not.

103
00:14:50.070 --> 00:15:01.680
Sarah Jeffreson: And that the molecular cloud light time a base of scaling relation and and this depends on the resolution of the maps that are used to identify the clock.

104
00:15:04.980 --> 00:15:06.000
Sarah Jeffreson: So, yeah.

105

00:15:06.420 --> 00:15:14.460

Morgan Elowe MacLeod: Thank you so much for linking fascinating dive into to have these clouds form and then evolve and work really good

106

00:15:21.990 --> 00:15:37.530

Morgan Elowe MacLeod: So can we start with a little bit of a question which I believe relates to some extent to the star formation timescale, and then like the lifetimes of these clouds which comes from floor, which is

107

00:15:39.270 --> 00:15:55.830

Morgan Elowe MacLeod: How and if our stellar wins modeled in this sort of simulation that might come after stars form. What's the treatment when stars are thought to form at the end of a cloud lifetime.

108

00:15:56.880 --> 00:16:02.580

Sarah Jeffreson: At the end of the cloud lifetime. I'm not actually in losing

109

00:16:04.800 --> 00:16:08.970

Sarah Jeffreson: The winds explicitly in the simulations. I'm not sure if that's what

110

00:16:11.010 --> 00:16:24.510

Sarah Jeffreson: He's asked here I'm if I go back to my simulation slide I have supernova and H two regions, but not wins explicitly is

111

00:16:24.510 --> 00:16:24.690

It.

112

00:16:25.860 --> 00:16:26.220

Sarah Jeffreson: Yeah.

113

00:16:27.900 --> 00:16:40.320

Sarah Jeffreson: Ah yes, no, so I am injecting the maximum wins. But that's just an order to conserve them that there isn't any energy or momentum associated with wins here yet.

114

00:16:43.530 --> 00:16:47.880

Morgan Elowe MacLeod: Interesting. And so when

115

00:16:49.140 --> 00:16:58.380

Morgan Elowe MacLeod: I'm really interested in this idea that you raised that the turbulent cascade to higher density is is such that

116

00:16:59.910 --> 00:17:04.560

Morgan Elowe MacLeod: The know 25 times over pressured clouds.

117

00:17:06.090 --> 00:17:09.330

Morgan Elowe MacLeod: Their properties are identical, regardless of environment.

118

00:17:10.710 --> 00:17:10.920

Morgan Elowe MacLeod: Yeah.

119

00:17:11.190 --> 00:17:13.950

Morgan Elowe MacLeod: Nice almost identical, which is

120

00:17:14.070 --> 00:17:20.040

Morgan Elowe MacLeod: Which is kind of amazing that something so universal arises out of something so

121

00:17:20.520 --> 00:17:24.210

Morgan Elowe MacLeod: You know, seemingly diverse as these different environments that you've modeled

122

00:17:25.980 --> 00:17:49.170

Morgan Elowe MacLeod: Can you talk about so clearly that's not the case with the more minimally over pressured H1 clouds. But can you talk a little bit about like how the environment affects if it does the like number or masses, or that sort of thing of the molecular clouds. The do form.

123

00:17:49.440 --> 00:17:51.330

Sarah Jeffreson: Yes, so here

124

00:17:53.490 --> 00:17:56.730

Sarah Jeffreson: You can see the cursor here. Don't just exit.

125

00:17:57.870 --> 00:18:05.490

Sarah Jeffreson: Here the property on the left hand side is actually the number of clouds per unit area and yes

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00:18:05.790 --> 00:18:07.320

Sarah Jeffreson: Also does have a correlation

127

00:18:07.440 --> 00:18:14.550

Sarah Jeffreson: With the environment. So there's a much larger number of cloud per unit area in the inner compared to the outer regions of the

128

00:18:14.550 --> 00:18:17.040

Sarah Jeffreson: Galaxy. Yeah, so

129

00:18:17.070 --> 00:18:23.700

Morgan Elowe MacLeod: If, for example, you were sheer dominated, you might be less likely to form a molecular cloud, is that correct

130

00:18:24.000 --> 00:18:26.010

Sarah Jeffreson: It seems that way. Yes.

131

00:18:26.040 --> 00:18:39.030

Morgan Elowe MacLeod: In interesting and then once you do. And once you've reached to that degree of decoupling from the environment that cloud might actually be kind of similar to a cloud elsewhere. Is that the idea

132

00:18:39.450 --> 00:18:44.910

Sarah Jeffreson: I would say that yes that's what the results are showing

133

00:18:45.480 --> 00:18:50.250

Morgan Elowe MacLeod: Do you think that means that I mean in star formation.

134

00:18:51.210 --> 00:18:51.660

Sarah Jeffreson: Mm hmm.

135

00:18:51.690 --> 00:19:06.870

Morgan Elowe MacLeod: We always have to sort of simulate the different scale separately because, you know, it's hard to do a star forming simulation that includes a galaxy down to the like proto stellar course.

136

00:19:07.740 --> 00:19:19.560

Morgan Elowe MacLeod: So do you think kind of the universality of these turbulent clouds is useful in that regard. Like, does that mean that isolating a cloud and simulating just a cloud is a viable strategy.

137

00:19:20.250 --> 00:19:24.690

Sarah Jeffreson: I would say this in on milky.

138

00:19:27.450 --> 00:19:28.650

Sarah Jeffreson: Milky

139

00:19:30.840 --> 00:19:33.090

Sarah Jeffreson: Play like

140

00:19:34.920 --> 00:19:36.960

Sarah Jeffreson: Galaxies it is perhaps

141

00:19:37.980 --> 00:19:38.430

Sarah Jeffreson: But

142

00:19:39.930 --> 00:19:45.720

Sarah Jeffreson: I think that as you increase the mass of the galaxy. There might be a greater degree of environmental variation

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00:19:47.250 --> 00:20:09.630

Sarah Jeffreson: And also here. I haven't included spiral arms or any other environments that might also be expected to change the properties of the clouds. So here, yes, perhaps, but as soon as you increase the mass of the galaxy or introduce fire alarms. For example, I would expect.

144

00:20:11.250 --> 00:20:14.940

Sarah Jeffreson: Expect this not to be the case anymore, actually.

145

00:20:15.060 --> 00:20:26.520

Morgan Elowe MacLeod: Fascinating, and will be really excited to hear the updates and we can continue the conversation more on Slack. But thank you for all of your insights on a great talk.

146

00:20:27.990 --> 00:20:30.870

Morgan Elowe MacLeod: Transition to be here. Thank you again.

147

00:20:34.230 --> 00:20:38.370

Ana Bonaca: Thank you so. Okay. Our next speaker is

148

00:20:39.570 --> 00:20:40.230

Morgan Elowe MacLeod: Father. He

149

00:20:40.620 --> 00:20:41.940

Ana Bonaca: Who is currently

150

00:20:42.510 --> 00:20:50.280

Ana Bonaca: postdoc at term and has been also co found gender Research Fellow there. So before that he has been

151

00:20:50.340 --> 00:20:53.820

Ana Bonaca: A PhD student in Victoria and the actual strength and

152

00:20:54.060 --> 00:21:02.820

Ana Bonaca: Started for University of Technology in a crowd Iran and even before that she was a gold medalist at the International Astronomical and yet.

153

00:21:04.530 --> 00:21:14.280

Ana Bonaca: So throughout her career as it has been a member of the Virgo collaboration, so she can be working on this cutting edge cosmological simulations.

154

00:21:14.820 --> 00:21:31.260

Ana Bonaca: And lead the efforts in particular to analyze milk away like environments, and most recently she has been looking into what happens to the satellite population of nuclear a simulator milk to ace. And I think this is what we'll be hearing about today. So take it away.

155

00:21:31.920 --> 00:21:32.700

Ana Bonaca: That was no

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00:21:33.060 --> 00:21:34.530

Azi Fattahi: I don't have you know about my high

157

00:21:34.530 --> 00:21:35.040

School

158

00:21:36.480 --> 00:21:37.170

Azi Fattahi: So, yeah.

159

00:21:38.400 --> 00:21:39.660

Ana Bonaca: Background checks are very

160

00:21:41.880 --> 00:21:43.410

Morgan Elowe MacLeod: nothing if not researchers

161

00:21:46.050 --> 00:21:46.530

Ana Bonaca: Okay.

162

00:21:50.130 --> 00:21:50.730

Azi Fattahi: Does it work.

163

00:21:53.040 --> 00:22:09.630

Azi Fattahi: Alright, perfect. Good day, everybody. I'm very happy to be ritually with you today to talk about my work in the past year or two, and I hope all of you are finding these strange just like difficult times. I hope you all surviving well

164

00:22:10.680 --> 00:22:21.390

Azi Fattahi: And we're going to hear more about actually not more after a Sarah but simulations, but about the door galaxies and monkey way the stellar Halo.

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00:22:21.960 --> 00:22:36.180

Azi Fattahi: And of course, as you said, my collaborators who I guess all these works are with their help. Allison and Carlos Franken Darwin and mercy in Cambridge and rigor simulation team that I will tell you a little bit more about that.

166

00:22:37.260 --> 00:22:52.290

Azi Fattahi: So the outline of my talk is all I'll talk about the Milky Way satellites and the formation of the stellar halos. If I have published work. And if I have time, I'll show like maybe two slides about what I'm thinking about are working on these days.

167

00:22:53.370 --> 00:23:00.150

Azi Fattahi: Very, very brief introduction. I'm sure you're all aware of the standard model of cosmology.

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00:23:00.600 --> 00:23:07.290

Azi Fattahi: This is a hierarchical galaxy formation, where most of the gravitating matter in the universe is dark matter. We have a big bang.

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00:23:07.710 --> 00:23:17.070

Azi Fattahi: At the beginning, where the density in the universe is relatively smooth and collapse of the structure leads to the formation of halos and sub halos.

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00:23:17.700 --> 00:23:37.410

Azi Fattahi: And as I said, this is a hierarchical hierarchical formation, a scenario, meaning smaller things merge and accrete and form

bigger objects. And this is kind of one of the robots corporate depictions of the standard model of cosmology. Here is just them.

171

00:23:38.820 --> 00:23:44.430

Azi Fattahi: Video of actually one of the article galaxy formation, you're looking at the dark matter on the very left

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00:23:44.940 --> 00:23:50.580

Azi Fattahi: And looking at the formation of basically stars on the very right. And we can see that actually there's

173

00:23:51.240 --> 00:24:07.170

Azi Fattahi: Quite a while you're seeing the hierarchical formation. You see all these little columns are getting created, but also there is a big difference between the formation of dark matter Halo versus the formation of the stellar component, which I am going to mainly focus on that today.

174

00:24:08.340 --> 00:24:17.040

Azi Fattahi: At present day. That's what the halo. On the right you can see what the Halo like a mature way, looks like we always stop halos or clumps around it.

175

00:24:17.520 --> 00:24:27.060

Azi Fattahi: And we see at least the bigger ones that look like satellites and we observed them on some Milky Way satellites, but the ones that have been

176

00:24:27.840 --> 00:24:35.970

Azi Fattahi: Created in the past gets disrupted. This is just from some numerical simulations in the past from dark matter only ones from the

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00:24:36.870 --> 00:24:44.910

Azi Fattahi: bullock, and Johnson, the more recent hydrodynamic or simulations, where we actually have a star article that again look at the formation of the stellar halos.

178

00:24:45.510 --> 00:25:01.890

Azi Fattahi: So these are another predictions that are from these hierarchical formation that we expect to see this a lot of stuff structures and this stellar Halo. That's actually relatively the fields around galaxies observational Lee, we see this beautifully.

179

00:25:03.570 --> 00:25:08.280

Azi Fattahi: Around the Milky Way. Here I'm showing a very nice work from Anna.

180

00:25:08.790 --> 00:25:17.640

Azi Fattahi: And we're looking at well in the Milky Way we are inside the galaxy. So we don't have some sort of an bird's eye view we see all the sub structures and streams.

181

00:25:18.330 --> 00:25:29.700

Azi Fattahi: If from inside the galaxy. You can see again on the left for the Milky Way and some galaxies out of galaxies Milky Way or another NBC for sense for

182

00:25:30.240 --> 00:25:36.750

Azi Fattahi: That we see these basically nice structures around these galaxies on Stellar halos.

183

00:25:37.500 --> 00:25:45.780

Azi Fattahi: And I like to study the connection between this component which is the stellar Halo that are our form from the disruption.

184

00:25:46.290 --> 00:25:58.020

Azi Fattahi: Of Dwarf galaxies versus the population that he survived today, which we just saw in the previous slides population today that survival as as satellites of the Milky Way.

185

00:25:59.250 --> 00:26:04.440

Azi Fattahi: I'm using Auriga simulations in this basically what happened is it

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00:26:05.790 --> 00:26:10.380

Azi Fattahi: Ok Auriga simulations. Basically, the results I'm showing are based on these

187

00:26:11.430 --> 00:26:28.170

Azi Fattahi: Simulation. These are a set of a milky way Halo masters is or tend to the total solar masses halos relatively isolated and they have been wrong with the galaxy form with apple on a galaxy formation model that is quite similar to the team model, there are slight differences.

188

00:26:29.280 --> 00:26:32.610

Azi Fattahi: That is kind of the backbone of the analysis. I'm going to show

189

00:26:33.870 --> 00:26:41.940

Azi Fattahi: And you're going to see a lot of plots may be labeled survived dwarfs or satellites versus destroyed ones. So I'll give you

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00:26:42.690 --> 00:26:54.060

Azi Fattahi: Kind of definitions of what I'm exactly talking about survive dwarfs or satellites, they are more straightforward to define these are basically that present day.

191

00:26:54.510 --> 00:27:05.940

Azi Fattahi: We observe these or in the simulations and refine this as boundary structures around Milky Way halos. They have non zero Stella mass, by definition, I call them galaxies.

192

00:27:06.540 --> 00:27:13.650

Azi Fattahi: And in regards simulations. Here the plot use you're looking at the luminosity function or stellar mass function of the satellites

193

00:27:14.400 --> 00:27:26.850

Azi Fattahi: Which are against survive dwarves compared to meet you and I'm 31 observation. So we can. Oh, sorry. It can see that actually at the very cool zero basically Stella mass function is relatively

194

00:27:27.540 --> 00:27:37.020

Azi Fattahi: Good match to what we observe the other population that I will talk about are these destroyed ones that are forming the stellar Halo.

195

00:27:37.680 --> 00:27:51.720

Azi Fattahi: And so they are I identify identify them by the fact that they do not have any bound or remaining structure and Richie zero. So they have been created at some time go

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00:27:52.680 --> 00:28:03.570

Azi Fattahi: I track things back in time, they have been created some time ago, but at Richard zero, we do not find any basically bound or survived entity in the simulations.

197

00:28:04.710 --> 00:28:12.000

Azi Fattahi: I want to emphasize that what if something is destroyed or not. It's a high debate if it's numerical or not.

198

00:28:12.420 --> 00:28:20.700

Azi Fattahi: What I want to emphasize that kind of a conservative interpretation is the fact that these are objects that have lost a lot of mass and they

199

00:28:21.330 --> 00:28:35.370

Azi Fattahi: contribute to the formation of the stellar Halo whether a tiny bit of them or remained or not for the results I'm showing are slightly irrelevant destroy doors dwarfs. You can see them as progenitors of this stellar Halo.

200

00:28:36.840 --> 00:28:42.870

Azi Fattahi: And I'm going to kind of discuss these two populations, whether they are survived, or they have been destroyed.

201

00:28:43.680 --> 00:28:51.870

Azi Fattahi: So this is similar to the plot, I showed before. This is the star mass function of objects that survived to present their satellites

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00:28:52.650 --> 00:29:01.410

Azi Fattahi: I'm just insuring that equals zero stolen Muslim flooring. There's the Dharma info. I can compare that with the population that have been destroyed.

203

00:29:02.100 --> 00:29:12.120

Azi Fattahi: And here the red ones. The blue one is just the copy from the left hand and the red ones that the population that have been destroyed. We can clearly see that at least on average.

204

00:29:13.200 --> 00:29:26.610

Azi Fattahi: There have been more in terms of number and mass more objects that have been destroyed, have been created and destroyed versus the one that have been survive. And then, actually, I can just combine the two population.

205

00:29:28.080 --> 00:29:35.550

Azi Fattahi: To find out the basically the total population of objects that have been created to the Milky Way throughout its lifetime.

206

00:29:36.420 --> 00:29:48.030

Azi Fattahi: And as we expected and the previous panel, most of the population that have been created are basically these destroyed a galaxies and survived ones or so population of that.

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00:29:49.230 --> 00:29:58.260

Azi Fattahi: And relatively actually what is nice is that there is a relatively small scattered around the mean of the stellar mass function of acquitted objects.

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00:29:58.710 --> 00:30:10.470

Azi Fattahi: And this is basically the result of the fact that when we have a template 12 solar mass Halo. It's a Christian history within Lando city and easy relatively well constrain so you combine

209

00:30:11.040 --> 00:30:29.580

Azi Fattahi: The occasion history from the halos and stop halos. And when you map the stars to that because also there is a good mapping between study mass on Halo mass we can find the basically and relatively narrow range of or and narrow scattering the stellar mass function of accreted objects.

210

00:30:31.080 --> 00:30:41.160

Azi Fattahi: And the fact that there are more destroyed ones immediately brings up the kind of the questions. Does it mean the mass of the stellar Halo is more than the mass of the

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00:30:42.870 --> 00:30:51.690

Azi Fattahi: Surviving objects or mass of the SATA total mass of the satellites. So at least these simulations predict that there are three times more mass

212

00:30:52.500 --> 00:31:01.410

Azi Fattahi: In that have been created and destroyed than the total mass of the satellites, but the lot of the mass goes to the very central region.

213

00:31:01.950 --> 00:31:10.590

Azi Fattahi: And not a lot last on part of the masculine, the central region and in the disk. So if I remove that basically the very central bit or the disk of the galaxy.

214

00:31:11.130 --> 00:31:19.440

Azi Fattahi: We find that the critical mass that have been destroyed and form the stellar Halo is more or less the same order of magnitude more point to where exactly

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00:31:20.400 --> 00:31:30.060

Azi Fattahi: Compared to a time the mass, mass of the satellite. So actually this is a nice connection between what we observe today and what we expect to see in the stellar Halo.

216

00:31:31.980 --> 00:31:44.010

Azi Fattahi: Um, the other point I want to kind of point out is the fact that the shape of the distal a mass function is relatively quite similar between these two survive and destroyed population.

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00:31:44.430 --> 00:31:57.240

Azi Fattahi: But there is a very strong and dependence on the info info time. So this is very similar to the previous plot previous panel previous sorry a slide but I divided the stellar mass function into

218

00:31:58.290 --> 00:32:07.740

Azi Fattahi: Objects that failing at different times. So survived galaxies there are three beans, two to 6 billion years after Big Bang, but it was zero is began

219

00:32:08.130 --> 00:32:17.820

Azi Fattahi: To the 6 BILLION YEARS, SIX TO 10 and the most recent one that are that are after 10 billion years. So in the last 4 billion years or so that have been acquitted.

220

00:32:19.500 --> 00:32:25.950

Azi Fattahi: That looks very different between the objects that are survived a tragic zero compared to the ones that have been destroyed.

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00:32:26.610 --> 00:32:33.120

Azi Fattahi: Will see that most of the destroyed ones are actually the objects that failing relatively early two to 6 billion years.

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00:32:33.420 --> 00:32:42.600

Azi Fattahi: There is no curve for more recent than 10 million years because actually they were very few satellites. I couldn't imagine protocol. It's just a handful of objects.

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00:32:43.320 --> 00:32:54.090

Azi Fattahi: That have been created recently that have not been destroyed and most of the destroy them on as also perhaps without and I really expected to have felling relatively early

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00:32:54.570 --> 00:33:00.600

Azi Fattahi: And again, the combination of objects. These are the ones that have been survived. Plus, the ones that have been destroyed.

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00:33:01.230 --> 00:33:15.810

Azi Fattahi: When we combine everything together, most of the population, again, is dominated by early info objects and the ones that have filling recently are relatively sub dominant compared to the other components.

226

00:33:16.830 --> 00:33:25.740

Azi Fattahi: We can see what I kind of described here more clearly. I'm looking at showing the info time of the objects versus their stellar massing fault.

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00:33:26.850 --> 00:33:36.300

Azi Fattahi: The blue objects are again the survived ones and the red ones destroyed and then the lines are the median at a given stellar mass

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00:33:37.440 --> 00:33:51.330

Azi Fattahi: We can see what I was describing before that the survived ones which are existing satellites failing relatively later and the destroyed ones early quite early. Actually, most of the population failing and

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00:33:51.840 --> 00:34:00.210

Azi Fattahi: Then the first two to four or five billionaires after the big one. The other interesting we see here is there are very little.

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00:34:00.810 --> 00:34:08.430

Azi Fattahi: Very few big objects one a big objects being here this is actually another another kind of

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00:34:09.030 --> 00:34:17.070

Azi Fattahi: Sign on the hierarchical formation, because we tend to the 10th at the nine or 10 to the few times 10 to the minus some orders galaxy takes time to form.

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00:34:17.610 --> 00:34:29.490

Azi Fattahi: So most of the ones that have been accreted accreted relatively later. That is the general trend. We see here that with mass, the two curves go higher and the other very

233

00:34:30.060 --> 00:34:40.890

Azi Fattahi: Interesting thing is that the survived want especially at the high mass and the one that I've been survived spelling very recently, or they almost all of them in the last four billion years or so.

234

00:34:41.220 --> 00:34:54.330

Azi Fattahi: And that's due to dynamical friction because big objects gets pulled the center because of the dynamic of friction and they merge very quickly on a very short time scale. So we see the effect of dynamical friction at them high mass at

235

00:34:55.650 --> 00:35:02.580

Azi Fattahi: This point in the info time and had some consequences for for some of the observable.

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00:35:03.150 --> 00:35:13.170

Azi Fattahi: Here I'm particularly looking at the mentality, or in this case, average if you were a child objects versus the stellar ma. So we have the mass metallic the relation here basically

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00:35:14.010 --> 00:35:30.720

Azi Fattahi: Destroyed objects to the average is the red curve and the survived ones at info. If I look at their properties are being forced on always comparing the properties that info. If I compare them at info, we see that the ones that survived or a bit more metal rich

238

00:35:31.740 --> 00:35:51.750

Azi Fattahi: And that's the consequence of actually there is a small, at least in the model, the small evolution of mass fatality relation. So here I am showing again spell our math versus mentality, or if you're over age and I color coded objects based on their info time, the ones that really early.

239

00:35:53.550 --> 00:35:57.990

Azi Fattahi: Are low and the one that's failing later or kind of higher so we

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00:35:59.220 --> 00:36:02.340

Azi Fattahi: Thanks, Anna, so we expect this

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00:36:02.580 --> 00:36:04.080

Azi Fattahi: Basically trend that

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00:36:04.530 --> 00:36:17.040

Azi Fattahi: This bias in a four time also translating the bias in the mass mentality. The relation and even more when we look at this very cool zero properties because when we look at that equals zero properties. Some of the objects in sinful.

243

00:36:17.520 --> 00:36:23.400

Azi Fattahi: They've lost some mass. So in this panel, they move to the left. And they also have been forming

244

00:36:23.940 --> 00:36:36.180

Azi Fattahi: A little bit of a star after info so they can enrich a little bit afternoon for so they go up. So actually, the difference between the destroyed want and that equals zero satellites become even bigger because of this effect.

245

00:36:37.380 --> 00:36:48.900

Azi Fattahi: So in the last five minutes I go over some of these stellar Halo related kind of science or questions about the formation of a stellar Halo from the destroy objects that I talked about.

246

00:36:49.560 --> 00:37:04.260

Azi Fattahi: So I in the simulations. We have a lot of power in terms of tracking all individual stars. So what I do is I, I take it, I take in a stellar Halo I track every individual single store to which progenitor came from.

247

00:37:04.920 --> 00:37:15.450

Azi Fattahi: And here is an example on the left is all the ones that let's say belong to the orange curve or all the particles that came in with one single massive project or

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00:37:16.680 --> 00:37:24.000

Azi Fattahi: A blue curve corresponds to all the particle that came in with a low mass Dorf galaxy.

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00:37:24.900 --> 00:37:35.520

Azi Fattahi: So I can basically look at the radio trends of the formation of the stellar hail and some we're looking at the enclosed mass in the left and some form of a mass fraction in shells on the right.

250

00:37:36.450 --> 00:37:43.590

Azi Fattahi: And again, blue things are lower my subjects, what we see that in the inner regions in a 20 K PC or so.

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00:37:44.040 --> 00:37:52.920

Azi Fattahi: Basically one or two, at least in this one example one or two objects are forming. Most of the stellar Halo. But when we go to the outer parts.

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00:37:53.460 --> 00:38:04.950

Azi Fattahi: The very small ones or lower mass objects is thought to just become important. But the inner regions or very few objects is needed to form the inner region, I can

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00:38:06.900 --> 00:38:14.220

Azi Fattahi: kind of summarize this what I showed in the previous slide was just one example I can summarize this over older regal halos.

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00:38:14.700 --> 00:38:27.690

Azi Fattahi: The way I do is I go to different pins of radius here, for example, zero to 20 2050 and so on. And I asked how many progenitors. Do I need to form 90% of the mass

255

00:38:28.110 --> 00:38:36.210

Azi Fattahi: So I basically rank them and I look at how many the top projectors, if you want to call them. How many main progenitors I need to form 90% of the mass

256

00:38:36.600 --> 00:38:46.950

Azi Fattahi: The inner regions we needed very few, on average, about three galaxies to form Dana regions when the outer parts we need more. So you can see clearly the trend with radius.

257

00:38:48.300 --> 00:38:59.700

Azi Fattahi: The other interesting point is that what do these presenter look like in terms of, for example, their stellar mass. So these are let's focus on one panel so I can explain what's going on.

258

00:39:00.120 --> 00:39:12.300

Azi Fattahi: So I go to basically the main progenitors of the inner region in between zero to 20 K PC. I asked, what is their stellar mass adding for and how much mass they contribute in that region.

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00:39:12.900 --> 00:39:21.450

Azi Fattahi: So if it's one, it means that one dwarf galaxy contributed 100% of the mass in that region. And if it's one, zero. Very little.

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00:39:22.140 --> 00:39:30.030

Azi Fattahi: And what we see is, basically, most of the mass and the inner regions are coming from massive doors galaxies. These are the ones that are shown on the top.

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00:39:30.990 --> 00:39:42.090

Azi Fattahi: And what we see that again in the at least in the inner regions, things that are below tend to the eight or so contribute very negligible. Basically the mastering the in your regions.

262

00:39:42.570 --> 00:39:51.960

Azi Fattahi: 99% of the mass in the inner region of this stellar Halo are coming from relatively mastic dwarf galaxies, not the tiny ones.

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00:39:53.130 --> 00:40:00.300

Azi Fattahi: trended slightly changes in the outer parts and the outer parts we start to see that lower mass galaxies also become important.

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00:40:01.140 --> 00:40:06.600

Azi Fattahi: But inner parts is what I like to focus on, because that is more or less, where we have the more or less at least with our current

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00:40:07.050 --> 00:40:12.870

Azi Fattahi: Facilities, we don't have a lot of information in the outer parts in the inner parts, as I mentioned, most of the

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00:40:13.290 --> 00:40:18.960

Azi Fattahi: Things are coming from. Very few objects. I'm just going to skip this dark matter and going to the metallic city.

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00:40:19.770 --> 00:40:34.320

Azi Fattahi: So the fact that most of the mass is coming from very big objects that affects the mentality formation of this dollar Halo here another one example of one of the halos. And I'm looking at the Metallica distribution of individual

268

00:40:35.670 --> 00:40:52.260

Azi Fattahi: So let's say individual curves here are stars that came in with different progenitors the mentality distribution in this whole Halo is in the black curve and a individual curve is any of those basically progenitors

269

00:40:53.640 --> 00:40:59.970

Azi Fattahi: We see basically there is a mass mentality relation which is actually what we saw before. This is the main mentality.

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00:41:00.270 --> 00:41:07.140

Azi Fattahi: The main mentality changes with mass. This is some sort of the color, the trend. You see, we call it is a mass mentality.

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00:41:07.560 --> 00:41:14.430

Azi Fattahi: But something that's interesting, even at the lowest math, at least in this example, even at the lowest scoring mentality.

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00:41:15.300 --> 00:41:28.800

Azi Fattahi: Still, the most massive doors galaxies are important basically their masters so dominant that even at the low mentality. They

are more the probability that the stars are coming from the little one is low.

273

00:41:30.030 --> 00:41:42.330

Azi Fattahi: And that general across all regal one Auriga halos. And this has important consequences because when we typically observe very metal poor stars we associate them with

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00:41:43.140 --> 00:41:52.770

Azi Fattahi: Low mass dwarf galaxies, but at least these models predict that even the low metallicity stars, we observe as part of this stellar Halo. They are

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00:41:53.220 --> 00:42:04.080

Azi Fattahi: Part of the tail of the distribution from the most massive dwarf galaxies here. You're looking at the let's focus on one curve again in a region zero to 20 K PC, which is blue.

276

00:42:04.650 --> 00:42:25.410

Azi Fattahi: I'm looking at the probability that a star is coming from a progenitor of tend to the nine or progenitor of tentative sticks or mass. So we can see that if you're rich below minus two, the probability is more than 50% that the Loma alone. The metal poor star is coming from the

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00:42:26.790 --> 00:42:31.650

Azi Fattahi: Basically dwarfs galaxy that's relatively massive. So that's the neat prediction that

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00:42:32.460 --> 00:42:40.050

Azi Fattahi: In the future, hopefully I can follow it up and combined with observations we can see if this is actually true or not. And because I'm

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00:42:40.860 --> 00:42:52.980

Azi Fattahi: Getting basically close to the end of my time and I will just simply say one word about what I'm doing these days is I'm looking at the spin of the stellar Halo.

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00:42:53.610 --> 00:43:03.420

Azi Fattahi: Which has been measured measured that has been relatively low and I'm connecting it with a christian history of the Milky Way that this guy, our sausage.

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00:43:04.350 --> 00:43:14.700

Azi Fattahi: prediction that has been going on thing that Milky Way has had this radio merger. In the past, I'm connecting these two and I

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00:43:15.240 --> 00:43:31.470

Azi Fattahi: Use a regal simulations to select the ones that look like do have this highly radial stars and connecting the spin of the stellar Halo to the formation history. I don't have time to go to the details, but just to give you a flavor of things. I work on these days.

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00:43:33.060 --> 00:43:45.630

Azi Fattahi: And as a wrap up, and the takeaway points that hopefully I'll like to stick with you is the fact that the destroyed population of doors galaxies destroy quotation.

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00:43:46.140 --> 00:43:53.340

Azi Fattahi: The ones that have lost a lot of mass and from the stellar Halo are dominant over the ones that we observe today.

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00:43:54.240 --> 00:44:09.990

Azi Fattahi: And most of them or for failing relatively early and compared to the survive galaxies and this in this bias in the info also reflects in demand reflects have a bias in the mass mentality relation we observe

286

00:44:11.430 --> 00:44:20.760

Azi Fattahi: And then on the formation of the stellar Halo, I would like to emphasize that the inner regions we need very few mastic doors galaxies to form the inner regions.

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00:44:21.870 --> 00:44:32.640

Azi Fattahi: And the low mass dwarf galaxies are almost irrelevant in a, in a region and that also has a consequence for for long before for metal poor stars.

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00:44:33.150 --> 00:44:44.010

Azi Fattahi: That at least in these models to predict that the middle poor stars are coming from high mass dwarf galaxies, rather than the very last ones. And I stopped here to take questions.

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00:44:45.420 --> 00:44:46.140

Morgan Elowe MacLeod: Thank you so much.

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00:44:54.540 --> 00:44:56.700

Morgan Elowe MacLeod: So can we start

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00:44:58.410 --> 00:45:00.450

Morgan Elowe MacLeod: By talking a little bit about

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00:45:02.370 --> 00:45:15.930

Morgan Elowe MacLeod: Where, and this is something that you're alluding to in these in even in these last bullet points, but like were destroyed objects are disrupted dwarfs and so

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00:45:19.980 --> 00:45:33.240

Morgan Elowe MacLeod: Do the ones. So Anna was asking for example, do the disrupted satellites that end up in the central part of the galaxy, do they become a bulge component or do they contribute to something separately.

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00:45:33.720 --> 00:45:43.470

Azi Fattahi: So here to kind of illustrate illustrate that what's going on. So here we are looking at the anger and the right, we are looking at all these

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00:45:44.310 --> 00:45:51.210

Azi Fattahi: Stars that coming from different destroyed to Earth galaxies, the ones that are coming from massive objects.

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00:45:51.720 --> 00:45:58.290

Azi Fattahi: Like the, the yellow, the yellow or the orange reddish colors. These already to be massive doors galaxies.

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00:45:58.830 --> 00:46:05.670

Azi Fattahi: And he does a mass fraction. But another way of looking at it. Is this some sort of a density profile. We can also see it on the left.

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00:46:06.300 --> 00:46:18.000

Azi Fattahi: The orange is enclosed mass, the orange one has most of its mass in the inner 20 K PC or so, but the little ones that have been destroyed, I end up in the outskirts

299

00:46:19.710 --> 00:46:33.030

Azi Fattahi: So, the ones that are in in the inner regions, I think, depending on what one. As you can see big day. These go down to I stopped at five K PC, but it goes even further down

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00:46:34.470 --> 00:46:48.780

Azi Fattahi: Just nicely. If you want to describe that the inner five K PC is bold actually in this very massive one and they deposit a lot of their mass in the inner that's a five K PC or so, which is bought

301

00:46:50.250 --> 00:46:59.220

Azi Fattahi: And some of them go to the desk. I haven't distinguished here, the ones that become some sort of the core rotating, it's a small population, but there is some of them.

302

00:46:59.550 --> 00:47:05.670

Azi Fattahi: And become co rotating with the disk and they become x to this stars, at least in this model, but

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00:47:06.660 --> 00:47:23.850

Azi Fattahi: Rule of thumb, the bigger ones because of dynamic of friction. They get some to the middle. They deposited a lot of mass in the middle. And depending on what you define as bulge. If it's the central whatever four or five six k PC. They definitely contributes significantly to the central

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00:47:25.170 --> 00:47:25.740

Azi Fattahi: I hope, like

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00:47:27.960 --> 00:47:29.640

Morgan Elowe MacLeod: So then, can we talk about

306

00:47:30.750 --> 00:47:41.940

Morgan Elowe MacLeod: How these dwarfs add up to the like properties of a given component. So, in particular the halo so on is also asking

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00:47:42.420 --> 00:47:55.620

Morgan Elowe MacLeod: Can you tell us more about your most recent work on the rotation of the halo and how common is it for a halo to be uniformly rotating and are there cases where rotation has opposite

308

00:47:57.900 --> 00:48:12.540

Morgan Elowe MacLeod: Like sign, essentially, or just slope as a function of radius and and I guess as I was thinking about this. It's almost like what if we had a guy in each of your simulated galaxies.

309

00:48:13.860 --> 00:48:19.440

Morgan Elowe MacLeod: That came to mind as you're showing us sort of the plots of the observable essentially I'm

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00:48:20.610 --> 00:48:30.990

Azi Fattahi: So going particular because Anna asked about the the halos been and the work that I'm doing. These are relatively preliminary

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00:48:31.590 --> 00:48:43.620

Azi Fattahi: I'm literally working on MTV days. So this is just basically if you were going to observe the spin of the stellar which is rotational this that are Halo in this various samples.

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00:48:44.580 --> 00:48:57.990

Azi Fattahi: On the left and right. I simply divide them into at from an earlier work of mine. I was identifying some of these Oracle galaxies that new have these sausage like component like

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00:48:59.040 --> 00:49:10.620

Azi Fattahi: This one actually see. So this one we're looking at the radio velocity versus identical velocity. This had this what people call guy a sausage, which is very radial

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00:49:11.160 --> 00:49:25.260

Azi Fattahi: Interstellar Halo. Basically, most of the interstellar Halo is dominated by this very radio component. So when I basically look at this time, divide the sampling to the ones that do have this guy a sausage versus not.

315

00:49:26.400 --> 00:49:29.880

Azi Fattahi: Here's the distinction I'm, I'm looking at the ones that do have this

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00:49:30.600 --> 00:49:34.410

Azi Fattahi: Is off the display radio component. They also have

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00:49:35.880 --> 00:49:37.380

Azi Fattahi: Little spin on average.

318

00:49:38.430 --> 00:49:52.830

Azi Fattahi: Small as the middle velocity versus the rest of the sample as you seeing actually can see the slope that you were asking about. They can have them very slow. Typically, the ones that have close to zero velocity, they're also more or less flat.

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00:49:54.330 --> 00:49:57.660

Azi Fattahi: And what is the question had one more part

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00:50:02.310 --> 00:50:05.220

Ana Bonaca: Yeah, I think you answered all of them. Oh, thank you so much.

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00:50:06.570 --> 00:50:09.330

Morgan Elowe MacLeod: Um, am I write that Josh, you had a question.

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00:50:09.900 --> 00:50:23.640

Josh Grindlay: Yes. Did you consider the contribution from a much larger primordial population of globular clusters which has been talked about a lot over the last several decades or more

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00:50:24.810 --> 00:50:24.990

Josh Grindlay: Did

324

00:50:25.320 --> 00:50:27.780

Josh Grindlay: You have a very large population. Why do they not

325

00:50:27.870 --> 00:50:29.280

Josh Grindlay: Contribute to the halo

326

00:50:30.480 --> 00:50:43.020

Azi Fattahi: I was the short answer. If I have looked at it, the short answer is no. We do in these simulations. These are cosmological ones we do not directly, of course, have global clusters.

327

00:50:44.400 --> 00:50:46.950

Azi Fattahi: And so I cannot directly

328

00:50:47.190 --> 00:50:56.070

Azi Fattahi: Kind of show anything my gut feeling is that the total mass because one has to look at the total mass has been accreted

329

00:50:56.700 --> 00:51:09.330

Azi Fattahi: Let's say when you create a dwarf galaxy that's tend to the nine, you would need how many 10 thousands of relatively massive global clusters to to to contribute similar mass

330

00:51:09.810 --> 00:51:21.210

Azi Fattahi: Whether that is reasonable or not. To be honest, I leave it to those who look at globular clusters formation and do we expect that we create about, I don't know 10 for

331

00:51:21.690 --> 00:51:35.550

Azi Fattahi: Global clusters and the history of the Milky Way and my gut feeling is that the the contribution from dwarf galaxies or in terms of mass. The contribution is the dominant over the mass foam roller coasters.

332

00:51:37.050 --> 00:51:48.480

Josh Grindlay: I think some of the earlier ideas were that the globular clusters more accreted but rather formed in the galaxy as we think the governor's we see now did

333

00:51:49.170 --> 00:51:58.590

Josh Grindlay: So the question becomes, if there was a very much larger population that formed and most of them have been disrupted. What is their contribution to the

334

00:51:58.830 --> 00:51:59.490

Azi Fattahi: Fair enough.

335

00:51:59.940 --> 00:52:01.140

Azi Fattahi: And I'm afraid that I

336

00:52:01.410 --> 00:52:12.600

Azi Fattahi: I cannot directly respond to that at least using these tools, but that's a very interesting questions and we know we see streams from rollercoaster. So they definitely contribute to this.

337

00:52:12.630 --> 00:52:19.110

Azi Fattahi: Yeah. Yeah. But I think quantitatively. We don't know. And hopefully we'll, we'll know at some point soon.

338

00:52:20.880 --> 00:52:21.270

Josh Grindlay: Thank you.

339

00:52:22.740 --> 00:52:30.540

Morgan Elowe MacLeod: Well, as a thank you so much. There's a couple of, I think, really kind of fascinating questions about how feasible, it is to take

340

00:52:30.540 --> 00:52:32.190

Morgan Elowe MacLeod: The next step from

341

00:52:33.510 --> 00:52:48.780

Morgan Elowe MacLeod: Understanding these correlations to then sort of reverse engineering almost or or like reconstructing the merger history. I like given object from these sorts of properties on the slack.

342

00:52:49.860 --> 00:52:55.620

Morgan Elowe MacLeod: But I think they might be a little bit more in depth than we have time to dig into in the next minute or so. So

343

00:52:56.820 --> 00:53:03.150

Morgan Elowe MacLeod: I think we should close now but we hope that you have a few moments to follow up.

344

00:53:03.480 --> 00:53:04.560

Azi Fattahi: So are you at all.

345

00:53:06.030 --> 00:53:06.360

Morgan Elowe MacLeod: Yeah.

346

00:53:06.630 --> 00:53:08.310

Azi Fattahi: Yeah, wonderful very fun.

347

00:53:08.520 --> 00:53:16.950

Morgan Elowe MacLeod: Well, um, let's thank both of our speakers for some really wonderful talks I learned a lot today and we're really grateful for your time and for joining us.

348

00:53:18.450 --> 00:53:19.170

Azi Fattahi: Thank you.

349

00:53:20.880 --> 00:53:21.480

Ana Bonaca: Thank you all.

350

00:53:25.980 --> 00:53:27.810

Ana Bonaca: We'll see you next week.

351

00:53:27.990 --> 00:53:29.190

Morgan Elowe MacLeod: See you next week. That's right.

352

00:53:30.510 --> 00:53:30.870

Ana Bonaca: Hi.

353

00:53:32.250 --> 00:53:32.790

Azi Fattahi: Bye.

354

00:53:34.140 --> 00:53:36.810

Morgan Elowe MacLeod: Bye, thank you again. Thank you. Bye.

355

00:53:45.930 --> 00:53:46.350

Thanks so much.