

WEBVTT

1

00:00:05.640 --> 00:00:06.089

Shmuel Bialy: All right.

2

00:00:08.010 --> 00:00:16.980

Shmuel Bialy: Okay, so we have the honor and the pleasure to have Paula Caselli with us, although virtually but, hopefully, as we said the Sunday, also in person.

3

00:00:17.609 --> 00:00:26.700

Shmuel Bialy: Paula is the director of the Max Planck extraterrestrial in a God thing of specifically of Center of astro chemical studies.

4

00:00:27.300 --> 00:00:34.650

Shmuel Bialy: And also under a professor of university of Munich, she has a long history, so I want the going through all the places and thinks.

5

00:00:34.980 --> 00:00:45.990

Shmuel Bialy: she's done just mentioned just few and 28 inches mid July professor of chalmers University in Gothenburg, Sweden, which is a very nice place, I visited recently I advise everyone.

6

00:00:46.860 --> 00:00:56.460

Shmuel Bialy: Since 28 inches I guess professor at also a space observatory in Sweden also and then 2020 she was the bolo professor at the University of Groningen.

7

00:00:57.120 --> 00:01:06.960

Shmuel Bialy: She spent quite some time at the CFA as a pre Doc and postdoc also, as some of you have seen, she knows everyone here and misses the place.

8

00:01:07.770 --> 00:01:22.380

Shmuel Bialy: she's working on various stuff star formation planet formation astro chemistry and today follow will take us through a journey from star formation to play information.

9

00:01:22.830 --> 00:01:31.500

Shmuel Bialy: Via linked all linked by astro chemistry so we'll be hearing all about this in a few minutes from now, they could form here Paula.

10

00:01:37.620 --> 00:01:40.920

Shmuel Bialy: We can't hear you Paula we can't hear you you're muted.

11

00:01:42.810 --> 00:01:44.190

Shmuel Bialy: Can you unmute yourself.

12

00:01:47.970 --> 00:01:49.410

Paola Caselli: Yes, sorry.

13

00:01:49.500 --> 00:01:52.950

Paola Caselli: I started this sharing it before i'm muting and then it was.

14

00:01:53.760 --> 00:01:55.440

Paola Caselli: OK, so I stepped over.

15

00:01:58.260 --> 00:01:58.950

Paola Caselli: me see.

16

00:02:00.120 --> 00:02:05.640

Paola Caselli: share, and now I do play do you see my slide.

17

00:02:06.030 --> 00:02:08.730

Shmuel Bialy: Yes, yes, we see AOL go ahead.

18

00:02:08.760 --> 00:02:17.760

Paola Caselli: Okay, very good so maybe tell me if you can tell me like five minutes before the time is ending.

19

00:02:20.220 --> 00:02:24.750

Shmuel Bialy: So I don't mistake and what is the five minutes, but when is the time ending exactly.

20

00:02:25.770 --> 00:02:30.180

Ana Bonaca: Now let's do 20 like a warning after 20 minutes so for 25 total.

21

00:02:30.630 --> 00:02:32.490

Shmuel Bialy: 20 minutes from now yeah.

22

00:02:33.090 --> 00:02:33.960

Paola Caselli: Right good.

23

00:02:34.050 --> 00:02:34.650  
Shmuel Bialy: Okay well.

24

00:02:35.040 --> 00:02:47.280  
Paola Caselli: So I I stopped them so it's a very excited actually to see you there so and it's too bad that I cannot be there with you and.

25

00:02:48.360 --> 00:02:54.480  
Paola Caselli: have some yeah chopped up with all of you, and so what do we do today, I will.

26

00:02:56.340 --> 00:03:05.310  
Paola Caselli: focus a little bit on some new stuff that we have been doing here, of course, thanks to the great people in my group.

27

00:03:05.910 --> 00:03:19.110  
Paola Caselli: And this is really to try to link these values faces that you see in this first slide that so we go from your passes came down to fractions of the path said.

28

00:03:19.650 --> 00:03:33.540  
Paola Caselli: and also to say protoplanetary the sky Sky, the planet formation, that is, see with the here, I will not really go into much detail, but of course there is.

29

00:03:33.990 --> 00:03:40.620  
Paola Caselli: Some link to what I will say about proud of mentalities, and it is all connected.

30

00:03:40.920 --> 00:03:53.790  
Paola Caselli: So I I start, I wanted to start actually with them, but I didn't have much time, so many slides so I got it, but I realized that this year is different, the diversity of the beautiful to map, but that was done in fact the by.

31

00:03:54.150 --> 00:04:00.660  
Paola Caselli: The name hartman and others, so in 2001, so I hope that you are going to celebrate that because that was an amazing.

32

00:04:00.990 --> 00:04:07.980  
Paola Caselli: achievement, so I typically start from there just to see to give us a sense of scale up on all these regions.

33

00:04:08.400 --> 00:04:20.370

Paola Caselli: But now I wanted to zoom in immediately to the regions that we have been studying, since many, many years, and this is actually dark clouds and the reseller court so, so this is that.

34

00:04:20.820 --> 00:04:37.980

Paola Caselli: some kind of zooming into the reseller course that is the initial stage or say you know, the object that contains the initial conditions, in a sense, in the process of starting and planet formation, so we are going to look into some new.

35

00:04:39.270 --> 00:04:41.400

Paola Caselli: words that we have been doing here.

36

00:04:41.820 --> 00:04:58.770

Paola Caselli: And the Just to give you an idea, this is a darker cloud the scene in this case by herschel in the dust continuation of 500 micro meter and here is that in color in 1.3 millimeter does continue not not for that was taken with the 30 meter telescope in Spain.

37

00:04:59.130 --> 00:05:09.240

Paola Caselli: And then here, you can see some throwing up all the structure of the so called priscilla course we now know that they are very centrally concentrated.

38

00:05:10.260 --> 00:05:24.150

Paola Caselli: And these sorts actually thanks to the work that I have done in these particular objects with Eric with here and in the pastor with feel, and so this is.

39

00:05:24.780 --> 00:05:34.020

Paola Caselli: showing that these regions and change their chemical structure, and this is important to know, because if you want to study them are from the.

40

00:05:34.410 --> 00:05:39.270

Paola Caselli: How they connect to the cloud down to the data Center when actually the future.

41

00:05:39.840 --> 00:05:52.170

Paola Caselli: products at a discount and stellar system we form, so we know that the very Center is reaching mutilated molecule so we not talk about the nutrition and this time, though, is one of the things that I must.

42

00:05:52.470 --> 00:05:58.410

Paola Caselli: Say like oh it's connected to the solar system, but just for the sake of time, I will.

43

00:05:59.010 --> 00:06:08.640

Paola Caselli: avoid that, but this is just to tell you that if you want to study the very Center of this course, you should choose the automated molecules because they're really good in placing these evaluations.

44

00:06:09.180 --> 00:06:16.080

Paola Caselli: So what we learned in the past few years is one very important thing from observations and also actually.

45

00:06:17.370 --> 00:06:29.250

Paola Caselli: In a sense, confirmed by here at just the raw data transfer of sensory concentrated the course it would be naked by the interesting additional fields that we know that the Tampa shooting these regions.

46

00:06:30.390 --> 00:06:39.000

Paola Caselli: drops powered the Center to very low temperature, this is data taken with the vla back in 2007.

47

00:06:39.600 --> 00:06:47.790

Paola Caselli: And you can see here that the rotation of temperature of ammonia which we use the ammonia one one into two to measure the temperature.

48

00:06:48.210 --> 00:07:02.310

Paola Caselli: drops from about to say fan in the outer part down to about six Calvin so in this condition so and we talked about you know Center density that about evolved into the six per cubic centimeter.

49

00:07:02.670 --> 00:07:15.930

Paola Caselli: In this condition, so you expect us to have most of the heavy elements so by heavy elements I mean all this species and elements headed and helium on the surface of the screens.

50

00:07:16.650 --> 00:07:24.990

Paola Caselli: This is a theoretical prediction, but I think we are getting close to actually finding out that this is indeed the case, and that will show you in the next slide.

51

00:07:25.500 --> 00:07:37.710

Paola Caselli: So in this condition, so you have basically kind of an early universe chemistry, also in hydrogen deuterium, and that is, we expected to be see that he.

52

00:07:38.220 --> 00:07:49.770

Paola Caselli: Also, easy to follow on the surface of that strain so actually what will happen, what happens in these conditions that is much more complicated because you have the stick is amount of.

53

00:07:50.250 --> 00:08:03.960

Paola Caselli: And of course you keep by having this cosmic rays that go through these regions and affect the chemistry and maybe breaking bonds and making more complex molecules.

54

00:08:04.680 --> 00:08:12.840

Paola Caselli: Fine, so what I want to show you now is actually jumping on this, something that we have been doing a very recently with the Alma.

55

00:08:13.440 --> 00:08:29.160

Paola Caselli: And this is something that I have to actually still securely mongo my co authors so so it's a, but it still is in good shape, but Baker, so we observe with the inbound three with Alma.

56

00:08:29.730 --> 00:08:42.750

Paola Caselli: This one of the setlist alert courses or 1544, which is in Taurus and is very bright and allow us actually to study in detail the inner structure, so we had the hear.

57

00:08:43.200 --> 00:08:54.930

Paola Caselli: Something like 300 astronomical units linear a resolution and we measure the part of different iterated ammonia, which has a critical density tend to.

58

00:08:55.350 --> 00:09:05.250

Paola Caselli: few times 10 to the six or so it's very good the food is the central region of crystal, of course, together with the three millimeter continuum and you can see here the napa.

59

00:09:06.060 --> 00:09:16.680

Paola Caselli: And what we found a, together of course with our chemical model, say, and that I get to transfer so basically hitting around the chemical model that includes the affiliated molecules.

60

00:09:17.220 --> 00:09:28.140

Paola Caselli: Taking the structure of the chorus We found that with Eric So this is the keto and it all 2015 paper, one of the most recent and then around.

61

00:09:28.650 --> 00:09:40.770

Paola Caselli: Radio transmitter on these, and you can see here the comparison between the observations that is in black and the model which is red and that these.

62

00:09:41.400 --> 00:09:55.320

Paola Caselli: fighters offset so from the Center of the score So you see the simulations and the observations that really in excellent agreement and the producers to this.

63

00:09:56.220 --> 00:10:06.270

Paola Caselli: Say line so here come from the side of abundance profile for the detonated ammonium so the decorated ammonia tend to have a peek at.

64

00:10:06.630 --> 00:10:22.830

Paola Caselli: The same time 1000 astronomical units and that starts to drop this is the abundance, so the number density of the integrated ammonia divided by the number 22 of each fractional abundance, so that you see that 2008 you there is a really sharp drop.

65

00:10:24.120 --> 00:10:34.470

Paola Caselli: in abundance and steal from this model, so I can ask the question, what is the total depletion factor which is defined by this.

66

00:10:34.950 --> 00:10:41.400

Paola Caselli: equation here so basically want to know how much of these heavy elements heavy species.

67

00:10:41.970 --> 00:10:47.640

Paola Caselli: heavier than helium are left in the dust phase, and you can see that this is a very small fraction.

68

00:10:47.850 --> 00:10:59.970

Paola Caselli: Within these 2008 you we find it depletion factor here of 10,000, which means that only point 01 percent of this heavy species and left in the dust face.

69

00:11:00.330 --> 00:11:16.740

Paola Caselli: So you have to think that, at this very early conditions and the amount of is in this dust grains is huge, you know your head, we have in fact hundreds and hundreds of nano layers advice in our simple.

70

00:11:17.220 --> 00:11:27.870

Paola Caselli: cool and this is, of course, is the initial conditions of the future product line that is in fact that this region has already started to flattened out and we see evidence for that.

71

00:11:28.440 --> 00:11:41.220

Paola Caselli: But let me move on another interesting thing about this presale, of course, is that they are also producing quite a large amount of complex organic molecules and this, of course, is important for.

72

00:11:41.670 --> 00:11:57.510

Paola Caselli: Our link to say formation of prebiotic molecules and also delivery of this material in the later stages of affirmation, this is another beautiful map are done by your mahara Hugh this was a paper published in 2020 where he.

73

00:11:58.650 --> 00:12:11.340

Paola Caselli: observed the affiliated ammonia again, this is the ortho one it doesn't matter they actually follow very similar structure, and this is hmm one one stably score in a few months.

74

00:12:12.150 --> 00:12:21.120

Paola Caselli: And you can see that the day ammonia is actually facing here a very well defined region, this is also where the data is present.

75

00:12:21.480 --> 00:12:36.120

Paola Caselli: But if you don't get the say, one of the simplest that complex organic molecules which is methanol, you see that men method likes to stay on the side, in a sense of engulf the core but it's mainly.

76

00:12:36.720 --> 00:12:52.080

Paola Caselli: From one side, and this is the side that is kind of more obscure from that ideation field that comes from the Ob association that that is a few parsecs always 11% so always somebody a few personal academic cloud.

77

00:12:53.040 --> 00:13:03.690

Paola Caselli: And that is the CDS of papers now showing that there is a really rich chemistry, we see complex organic molecules that before they were only observed in.

78

00:13:03.990 --> 00:13:09.840

Paola Caselli: hardcourts in these regions, where we know that ISIS are coming off the grains because that they are.

79

00:13:10.380 --> 00:13:23.640

Paola Caselli: heated by the nearby process star, but the now we see them announce the end the actually it's not just interesting for the chemistry, I think, from my point of view is even more interesting because these molecules will give us clues.

80

00:13:24.060 --> 00:13:36.510

Paola Caselli: On this connection from core to cloud, which we are still struggling to understand that you know how the corporate network to the cloud, and if there is still a creation going on, so this is something say for the future.

81

00:13:36.990 --> 00:13:55.440

Paola Caselli: From the point of view of the chemistry and we understand the what is going on in these each side, for the quality of the slide but they like to the movie the movie curves are so keep I keep showing these so once we had that our say.

82

00:13:56.670 --> 00:14:12.270

Paola Caselli: Cultivation so for complex organic goals in the 1544 core and we decided this was saying 2017 with the unconference you wanting to actually around chemical mode so to understand why we see these complex organics.

83

00:14:12.840 --> 00:14:24.390

Paola Caselli: At some radius outside the Center, of course, in the Center they are depleted so they're frozen onto the grains but they start to form a in a very specific region.

84

00:14:24.900 --> 00:14:34.620

Paola Caselli: The is a certain specific distance from the Center of this Bristol, of course, what is this distance so well the distance that is exactly where we have.

85

00:14:35.130 --> 00:14:45.360

Paola Caselli: The beginning of the catastrophic see off result, so the car is, as I mentioned already at the beginning it's an awesome also the heavier species.

86

00:14:46.680 --> 00:14:59.100

Paola Caselli: Other molecules containing carbon oxygen etc freeze out above a certain volume density and this number is about the few times 10 to the fourth but cubic centimeter, at least in the nearby clouds like.

87

00:14:59.520 --> 00:15:15.900

Paola Caselli: oreos etc, so what that better in this region, where you have the catastrophic result of CEO you have an icy mantle to that are completely reach the NCO and these changes in chemical composition for water which are.

88

00:15:17.160 --> 00:15:25.650

Paola Caselli: called molecules much more tightly because of its pollen measure to see all which is apple sounds a bit too much lower.

89

00:15:26.730 --> 00:15:36.720

Paola Caselli: moment, you have the possibility to make molecule on the surface and lead them to sort, and this is what is happening, this is what i'm Tom found.

90

00:15:37.200 --> 00:15:49.650

Paola Caselli: Here, and this is the abundance is a functional radius in the Second, we find that in fact that the complex organic molecules to have peaks that coincide with the CEO depletion zone.

91

00:15:50.220 --> 00:15:55.440

Paola Caselli: And these, in fact, there was something so we included in the chemistry this measure.

92

00:15:56.220 --> 00:16:08.430

Paola Caselli: rate, this option which patients that come from a laboratory work from me solid do you in Paris and, of course, taking into account the photo is optional rate the from the work of kalin.

93

00:16:09.240 --> 00:16:18.510

Paola Caselli: and other people at the end also of course experiment, though, and theoretical studies with neutral neutral reactions, but i'm not going into these details here.

94

00:16:18.750 --> 00:16:31.560

Paola Caselli: So we think we understand what's going on, so we have a very nice factory of complex organics in these regions, now we go to later stages so.

95

00:16:32.340 --> 00:16:51.030

Paola Caselli: This is solid, this is a super simplify so not all but why does anything they're proud of the inner inner peace corps, and that is not monetize, of course, you have magnetic fields, so you have a ionization fraction so you have, of course, is to take into account the fact that.

96

00:16:52.080 --> 00:16:52.830

Paola Caselli: You have.

97

00:16:54.030 --> 00:17:00.270

Paola Caselli: Basically, some sort of an apology huge and that's going on and through these through these clouds.

98

00:17:00.750 --> 00:17:10.500

Paola Caselli: And rotation initial invitation of the cloud that, of course, a give rise to a proper mentalities, although it's not so simple, as I said that, because in fact that.

99

00:17:10.710 --> 00:17:19.890

Paola Caselli: If you can see that the magnetic field, for example, is frozen, it will be very hard to actually make it a profitable entity, this could because of the.

100

00:17:20.460 --> 00:17:36.630

Paola Caselli: Very well known, the magnetic breaking a catastrophe that, of course, you get the too much magnetic flux our the Center use the angular momentum ended these 2004 so we have to get actually understand how to go from these as a reseller course to.

101

00:17:38.520 --> 00:17:45.630

Paola Caselli: This here, I put some examples I mean there's some people in the past, I had been thinking that the very beginning, this this.

102

00:17:45.900 --> 00:18:02.580

Paola Caselli: Probably sounds gravitating because they are create a lot of master from the mouse and envelope, but that is the ending this class zero stages, and if that is the case, so that is actually quite interesting because they can get very hot and we'll show you that in a minute.

103

00:18:04.200 --> 00:18:11.700

Paola Caselli: And now, these are some example of in fact that this that in the past section, when I was in Leeds so we started with the former students.

104

00:18:12.150 --> 00:18:22.980

Paola Caselli: about the chemistry of these systems gravitating discs but now more recently with Bo Xiao who just left actually he's not with the food itself, but he was with me for.

105

00:18:24.090 --> 00:18:27.900

Paola Caselli: Several years when I arrived and what being born.

106

00:18:30.420 --> 00:18:31.500

Paola Caselli: So he's.

107

00:18:32.640 --> 00:18:34.470

Paola Caselli: He has been working on.

108

00:18:35.580 --> 00:18:44.010

Paola Caselli: Non ADHD and and what we did that, together, when he came is to include the some simple chemistry in his code.

109

00:18:44.730 --> 00:18:58.500

Paola Caselli: And also, so the simple chemistry was more mostly aimed at following the items, because we know ionization fraction is so important in this contract tick mark magnetized cloud, so what.

110

00:18:59.430 --> 00:19:05.610

Paola Caselli: They thought was to implement that they grow in size distribution that you know the usual cosmic rays that.

111

00:19:06.450 --> 00:19:10.350

Paola Caselli: your eyes and you can also change these parameters flocks of cosmic rays.

112

00:19:10.980 --> 00:19:30.210

Paola Caselli: And you can change the initial rotation must flux ratio and all these parameters so but we noticed that actually very important the parameter was the grain size distribution itself so, for example, we try, assuming that the small grains are actually say gone from the.

113

00:19:31.380 --> 00:19:39.840

Paola Caselli: From the last phase and we didn't actually follow the calculation of the grains stuff consistently, but we just truncated the day.

114

00:19:40.200 --> 00:19:49.320

Paola Caselli: Mr Mr distribution, so the greatest distribution that we were using avoiding the smaller grains and we noticed that some kind of magic happen because.

115

00:19:49.740 --> 00:19:57.930

Paola Caselli: These that's great every well, coupled with the magnetic field, so they are the ones that mostly Braga these new neutral and.

116

00:19:58.440 --> 00:20:12.120

Paola Caselli: say in the Center, together with the magnetic field that slow down at a contraction However, if we move them up, we can actually get much higher the facilities in me politics, usually.

117

00:20:12.630 --> 00:20:26.850

Paola Caselli: The facilities and then this reduces the magnetic flux in the Center and we can form, and these are so just to give you an example in the top and you have a different one of the now with the this very small grants and you can see that.

118

00:20:27.360 --> 00:20:46.980

Paola Caselli: it's all really chaotic and, at the end, the Okay, you can head out flows, but very tiny plumes said no discs in tula but without, that is, that is my brain said, you could form actually relatively larger rotational support this and also set gravitating discs.

119

00:20:48.120 --> 00:21:02.520

Paola Caselli: Now i'm not going into these details, but just to tell you that, in fact, that we then started with heather on a csv s amp P, they this question of do very small brains deplete.

120

00:21:03.900 --> 00:21:14.820

Paola Caselli: faster in in molecular clouds and, more importantly, dense course we are mostly interested in depletion of them in this high density region so just before proprietary this perform.

121

00:21:15.810 --> 00:21:29.910

Paola Caselli: And the answer is yes, as long as you have that these drifting of the material due to the on the part of the fusion, so the small grains actually get stuck on the larger grains, and this was.

122

00:21:30.960 --> 00:21:37.410

Paola Caselli: shown that this is one of the figure of the paper by can see the speed that appear last year, where we show.

123

00:21:37.830 --> 00:21:49.140

Paola Caselli: The distribution issue distribution of the grain size and then depending on the if you have them be part of the fusion, yes or no, and if you have some food brands.

124

00:21:49.350 --> 00:22:05.670

Paola Caselli: Yes, so this is a sonic toward brands or not or brands, of course, you have different changes in these great size distribution back to define our conclusion was that it is very efficient to have these grain small grains depleted.

125

00:22:06.840 --> 00:22:09.000

Paola Caselli: So this model so that body.

126

00:22:10.260 --> 00:22:14.880

Paola Caselli: From my point of view, of course, you know i'm a little bit biased in this case about the data really.

127

00:22:15.480 --> 00:22:27.360

Paola Caselli: Say provides a good understanding of this that are now we're seeing with Alma and, in particular, so these are the simulations from both just changing a little bit the, for example, daily show.

128

00:22:27.840 --> 00:22:47.460

Paola Caselli: cosmic radiation rate that you can or and then this very small grains and you can make, as I said, the stuff that i'm taking this or fragmented fragmentation and these in fact that has been seen these are beautiful data from my foot up on this, so that he took with.

129

00:22:49.350 --> 00:22:49.680

Paola Caselli: It.

130

00:22:50.340 --> 00:22:51.960

Shmuel Bialy: A few a few minutes left.

131

00:22:52.290 --> 00:22:58.380

Paola Caselli: Yes, thank you, thank you, thank you, yes I don't have too many more I think so.

132

00:23:00.270 --> 00:23:04.710

Paola Caselli: So I lost today so here and.

133

00:23:05.820 --> 00:23:11.220

Paola Caselli: This is a very recent paper that has been just submitted from my students you're in.

134

00:23:13.110 --> 00:23:25.830

Paola Caselli: This is the yucky met somebody who has been working with Maria Jose Maria, and so there is, indeed, so this is the new point that I wanted to bring so.

135

00:23:27.090 --> 00:23:38.280

Paola Caselli: We have been observing with the high angular resolution and these one of this class zero feminists, that is, in a few other side I 1623, this is one of the.

136

00:23:38.970 --> 00:23:42.480

Paola Caselli: Sources it's a three part system, and this is the northern source.

137

00:23:42.900 --> 00:23:53.250

Paola Caselli: So, with the highest resolution here, you can see the beam, and this is the 20 you three millimeter is even higher resolution that one millimeter here with Alma.

138

00:23:53.490 --> 00:24:09.060

Paola Caselli: So we have a very bright fluxus and actually the brightness temperature can reach us at 400 kelvin power, the Center now we try that to actually simulate that so to have the simulations observe the simulations.

139

00:24:09.570 --> 00:24:19.200

Paola Caselli: And the see if they match the data, and in fact that what we found is that Okay, this is not actually the observed simulation because I had.

140

00:24:19.590 --> 00:24:27.690

Paola Caselli: to choose a witch of figures to show this is just the simulation itself is a slice that we see say face on and also add on.

141

00:24:27.960 --> 00:24:35.790

Paola Caselli: Showing actually the temperature of the gas and the dogs and the dogs, but he had a couple because the densities are very high.

142

00:24:36.390 --> 00:24:43.950

Paola Caselli: And it so if you get screwed the data Center where the code that actually doesn't have enough resolution actually to.

143

00:24:44.700 --> 00:24:53.430

Paola Caselli: look into the structure temperature sector, we see that the produce the classes, that we observed in these sorts.

144

00:24:53.760 --> 00:25:07.050

Paola Caselli: We need to have, but this assertion gravitating this better heated by internal shocks are produced by the spiral arms so that that actually form because of the self and gravity, so this can be really hot.

145

00:25:07.740 --> 00:25:12.000

Paola Caselli: And so, by hot, I mean really you know five or 600 kelvin.

146

00:25:12.570 --> 00:25:23.310

Paola Caselli: And we see these the evidence of increase of temperature tower to meet the plane, so the meat plane is hotter than the other parts of the disc in this case, so it is very initial.

147

00:25:23.760 --> 00:25:37.590

Paola Caselli: phases so i'm not saying that all that this could be like this, but at least some are like this one, which means that the all the material all the molecules so that that have been created in DC central region.

148

00:25:37.860 --> 00:25:51.990

Paola Caselli: will be all the ice will be evaporated and there will be some kind of strong reset, and this is the big thing because you know, then, once a Okay, then who cares about this prisoner core chemistry because you're.

149

00:25:52.410 --> 00:26:03.960

Paola Caselli: you're just telling me all this thick ISIS and then, then all evaporated well I think it's not the end of the story, because in fact that these regions are not the.

150

00:26:05.520 --> 00:26:21.660

Paola Caselli: Sea salt in this class zero state you still have a very massive envelope with material falling down continuously and we see actually evidence of these larger streamers, and this is the work of behind it, for example in pen tool this pursues class zero sorts.

151

00:26:22.170 --> 00:26:32.340

Paola Caselli: And where there is a very well defined out flow, that was the map with the SME this by Steven Tyler in 2018.

152

00:26:32.910 --> 00:26:45.420

Paola Caselli: What the home, I found that using oil, am I actually have a better picture of these is that, for example, he simply and the comes directly from the cloud the surrounding the end, but all of the of the.

153

00:26:46.230 --> 00:26:53.400

Paola Caselli: Of the throttle stellar object this material is flying towered the the Center and.

154

00:26:53.730 --> 00:27:07.050

Paola Caselli: High medium or low for these actually showing that the velocity that we see is consistent with the these are kind of you know, in flowing material from the cloud in fact ah Sydney and it's not the one that that all.

155

00:27:07.320 --> 00:27:13.320

Paola Caselli: In evolve, the clouds it's an early type molecules mass come from region so that is a more.

156

00:27:13.830 --> 00:27:23.040

Paola Caselli: than five it out, and you can see that the direction of the streamers is completely different from the direction of the outflow so the two things are not going to gather.

157

00:27:23.670 --> 00:27:33.540

Paola Caselli: and very recent stuff, for that is still a work in progress so it's the same source and now i'm looking with no am I in fact that we have the larger project.

158

00:27:34.140 --> 00:27:43.500

Paola Caselli: That covers 32 plus zero and one sources and also eight plus two sources, this is a project together with Thomas ending so putting together and plda.

159

00:27:43.920 --> 00:27:55.980

Paola Caselli: Where we see in fact that this, so the Center regional Center in that envelope let's put it in this way is very much affected by the streamers so that we are finding it and larger scale.

160

00:27:56.910 --> 00:28:08.790

Paola Caselli: This is all with noise and other streamers so, not just in class zero, but even class to where you could say this is actually a class one to two sorts.

161

00:28:09.240 --> 00:28:18.780

Paola Caselli: That has been recently observed by Philippe and basically this with Alma there is no envelope, but here, that is a nice beautiful disk.

162

00:28:19.230 --> 00:28:34.050

Paola Caselli: That is seen a drama with the Nice cavity but that you see with the CEO two to one beautiful streamers that again bring in material into the disk So even if you have this initial phase that basically evaporates everything.

163

00:28:34.350 --> 00:28:45.780

Paola Caselli: You keep bringing in this cold icy stuff from the envelope and the cloud, and of course this will affect the dynamic and evolution of the DS In fact the streamers may even.

164

00:28:46.260 --> 00:28:51.210

Paola Caselli: This was suggested by the nature of paper by cigarette box it.

165

00:28:52.170 --> 00:29:02.640

Paola Caselli: In 2020 in collaboration with several people from actually also CFA where it's obvious that if you had the streamers a symmetric flow of material they will.

166

00:29:03.060 --> 00:29:11.700

Paola Caselli: input a symmetries the end the creator say substructure in the disk that may even promote the formation of them.

167

00:29:12.420 --> 00:29:25.590

Paola Caselli: See rings and also maybe planets, so this is my last slide that but and is the actually this work is from gross the sky Italia back at this just to show that that in fact that I think that there is still hope.

168

00:29:26.130 --> 00:29:39.390

Paola Caselli: about the these say inheritance of material from the cloud to the disk and future brought the planetary system like our sun, because this was a comparison between organic.

169

00:29:40.650 --> 00:29:41.430

Paola Caselli: And in.

170

00:29:42.660 --> 00:29:44.430

Paola Caselli: The feminist field, so this is the.

171

00:29:47.070 --> 00:29:56.130

Paola Caselli: system and the comment showing it very good correlation that can talk to the author said that you know the bullet as composition.

172

00:29:56.580 --> 00:30:04.890

Paola Caselli: of Communism and planetary must be partially narrative from pre and perinatal stellar phases of evolution and other work that actually.

173

00:30:05.250 --> 00:30:19.440

Paola Caselli: We have done for a phosphorus building molecule, so this is with the Ruby light in 2020 So this is the conclusion I think i'm over one and a half minutes or so maybe I stopped the here and I discussed with you.

174

00:30:20.760 --> 00:30:20.970

Shmuel Bialy: Thank you.

175

00:30:21.270 --> 00:30:22.050

Paola Caselli: for being late.

176

00:30:22.380 --> 00:30:23.610

Shmuel Bialy: it's fine it's fine.

177

00:30:25.080 --> 00:30:26.760

Paola Caselli: Thank you, thank you, thank you.

178

00:30:26.940 --> 00:30:29.520

Shmuel Bialy: So much for these very interesting results.

179

00:30:29.820 --> 00:30:39.210

Shmuel Bialy: So let's see if there's question and I can already say that I hope there's not too many because I have lots of questions and if there's not too many questions i'll ask you many questions.

180

00:30:39.990 --> 00:30:43.050

Shmuel Bialy: But let's see if this other people first, before I.

181

00:30:43.080 --> 00:30:48.660

Shmuel Bialy: start with my okay so phil myers I see it went to ask, yes, go ahead felt okay.

182

00:30:48.690 --> 00:30:49.440  
Philip C. Myers: Can you hear me.

183  
00:30:49.860 --> 00:30:50.580  
Paola Caselli: Yes, yes.

184  
00:30:50.670 --> 00:30:54.390  
Philip C. Myers: But anyway, well lots of really interesting results power.

185  
00:30:55.800 --> 00:31:10.590  
Philip C. Myers: Just one particular thing I found intriguing do you have an estimate of the mass accretion rate due to the flow in the streamers and also how does that compare to the expected rate from the disc.

186  
00:31:11.340 --> 00:31:14.250  
Paola Caselli: Yes, so let me see so it's a little bit.

187  
00:31:15.330 --> 00:31:16.170  
Paola Caselli: How to say.

188  
00:31:19.260 --> 00:31:26.040  
Paola Caselli: I tell you the number and then I tell you how we that i've done that, because you know, we have not yet say.

189  
00:31:29.610 --> 00:31:37.140  
Paola Caselli: We need to find this a more accurate I think way to measure this info rate, so we found, for example in this.

190  
00:31:37.830 --> 00:31:49.830  
Paola Caselli: particular case here of using the htc an installer rate that is the of the order of 10 to the minus six solid masses fit here and.

191  
00:31:50.490 --> 00:32:04.200  
Paola Caselli: So it's not so different actually from you know what the new can expect for at this say age of the cloud now here, there is the assumption about the abundance of this molecule.

192  
00:32:05.250 --> 00:32:16.050  
Paola Caselli: Because that we only have a here in one transition, so we are trying to actually refine this type of study to actually have a better estimate of the.

193

00:32:16.470 --> 00:32:32.490

Paola Caselli: volume density, for example, from a multiples transition of the same streamer and try to understand the better the mouse, but from these that has been studied more accurately, so far, we have the sentiment of six sort of mouse's video.

194

00:32:34.680 --> 00:32:35.730

Philip C. Myers: Is that based on.

195

00:32:37.050 --> 00:32:40.620

Philip C. Myers: kinematic you know doppler motions.

196

00:32:42.000 --> 00:32:43.140

Philip C. Myers: abundance estimates.

197

00:32:43.500 --> 00:32:58.710

Paola Caselli: Yes, exactly, so we assume that is abundance, with respect, that which to for gauge city and that I think was so we look at you know at some abundance db Hella balances of ASEAN HC three and a molecular clouds.

198

00:33:00.330 --> 00:33:11.880

Paola Caselli: which of course is different, depending where you look so we took an average of that and we assumed that as our number here, so I don't remember now, I think it was something like 10 to minus nine.

199

00:33:12.930 --> 00:33:25.530

Paola Caselli: So you know you could have some error bars there, so we are trying to do better in this for this, because that is very important, so it's it's something we really need that to find a better way.

200

00:33:27.000 --> 00:33:28.770

Philip C. Myers: Okay, great great stuff.

201

00:33:29.220 --> 00:33:29.910

Paola Caselli: Thank you.

202

00:33:30.270 --> 00:33:40.770

Shmuel Bialy: Impala just to continue feels point so Could they not equilibrium chemistry help and data mining the time scale and then we find the these are Christian rates.

203

00:33:41.880 --> 00:33:54.930

Shmuel Bialy: So, for example, you look at these different molecules and you see how how if they're in equilibrium, or how far from equilibrium, they are, and this gives you an estimate of the time scale that have been in the region.

204

00:33:57.300 --> 00:34:12.420

Paola Caselli: So I think yeah that's a that's a good point that I tell you what I think is going on and again we have follow up a project actually here observational to test studies idea so.

205

00:34:13.410 --> 00:34:20.820

Paola Caselli: I think the htc and it's actually coming from the cloud that to sit down, so I think I mentioned this.

206

00:34:21.810 --> 00:34:32.970

Paola Caselli: Earlier from the cloud that that the lower density cloud that that that in hostile the core in which these protostar has formed.

207

00:34:33.630 --> 00:34:43.650

Paola Caselli: And so the cloud the is probably you know, has an average density volume density of the order of the tend to the three few times and to the three.

208

00:34:44.610 --> 00:34:57.090

Paola Caselli: or number two, we are in person is it's it's very say you see a lot of filaments elementary structure in on other age of the the densities of the order of dentistry.

209

00:34:57.630 --> 00:35:03.180

Paola Caselli: That maybe you know between 10 to the 10<sup>10</sup> to the fourth I cannot tell you the exact the body.

210

00:35:04.110 --> 00:35:08.730

Paola Caselli: These values so of the entity chemistry let's say is.

211

00:35:09.150 --> 00:35:28.290

Paola Caselli: An altar you still have some photons from the infiltration filter that partially say dissociated this your and can liberate carbone you can keep some kind of I think equilibrium abundance or the HC 3am around together with CEO and other molecules so because it's just you know this.

212

00:35:29.940 --> 00:35:40.560

Paola Caselli: Car the Association for the dissociation and formation of carbon chain, so that at some point, that will liberate and and you have it there and then, if this material is actually coming.

213

00:35:41.190 --> 00:35:55.200

Paola Caselli: In basically fun nail down inside that an answer core and you know you can have some time a scale, so it cannot survive longer because, again, you know it takes them.

214

00:35:56.100 --> 00:36:16.860

Paola Caselli: But still, it can take about the more than definitely more than 10,000 years so to to be transformed into See also, this is not the what we see, so this must be something much younger disclaimer than that okay and, but it is really that actually coming doesn't have the time to actually.

215

00:36:18.330 --> 00:36:29.460

Paola Caselli: evolve chemically within the core and it is directly transport that say into into the the onto the disk or any way into the inevitable, but I don't say because.

216

00:36:30.000 --> 00:36:43.710

Paola Caselli: We, of course, we are looking into these say interaction with the East go, we have some high angular resolution data, but still a work in progress and it's not yet so clear but definitely You know, as I show you.

217

00:36:44.430 --> 00:36:57.690

Paola Caselli: In the next the slider there is already in this sorts evidence from our preliminary data from Emma that, for example, the sea of glass and to the classes are very good tracer have a.

218

00:36:58.770 --> 00:37:05.010

Paola Caselli: cold gas, they are this distributed differently, and we have some kind of hola here.

219

00:37:05.340 --> 00:37:15.270

Paola Caselli: that we believe is probably the region where this flux, is the streamer is impacting but you see, I mean I didn't say much about the reports that we are working.

220

00:37:15.750 --> 00:37:21.570

Paola Caselli: and on these, and we need to find the proofs mostly shocks.

221

00:37:22.560 --> 00:37:40.890

Paola Caselli: indicator, and in fact that that is a good indicator which is yes, I you're excited the so liner here you're seeing greener, so that is some evidence of shocker but i'm not yet completely convinced we need, we need to get into more detail that you know yeah sorry for the long dancer.

222

00:37:40.980 --> 00:37:42.990

Shmuel Bialy: Go This is exactly what I meant was.

223

00:37:43.020 --> 00:37:53.760

Shmuel Bialy: What you said there is some time that it could be couldn't be too long, otherwise you'd expect the different chemical composition, which you do not see because I actually.

224

00:37:54.240 --> 00:38:06.870

Shmuel Bialy: I encounter as I had a similar problem and idea with on larger scale and maybe i'll i'll mention this in a moment after I verify that there is no more question actually and.

225

00:38:07.530 --> 00:38:19.710

Shmuel Bialy: asked the question on the larger scale and no but I chuck so Anna is asking what about the impact of the large scale structure on the structure of this.

226

00:38:20.850 --> 00:38:31.230

Paola Caselli: Right, yes, so indeed the you know, this is really now telling us that even this map here, which is done, you know, this is a.

227

00:38:31.770 --> 00:38:49.890

Paola Caselli: few thousand and you it's not enough, we need to move farther so because this is the same primary be mad that we have within our emr So you see that we really there is still a mission going on here, so the plan, and now is, we have already.

228

00:38:50.940 --> 00:39:05.760

Paola Caselli: High may actually have submitted the single dish proposal to larger, more say mouth, but of the region in http and to really follow these to the kind of end the point and see so what I.

229

00:39:07.260 --> 00:39:10.680

Paola Caselli: Well, again, I mean I don't like to say, think so, when there's no proof.

230

00:39:11.130 --> 00:39:22.170

Paola Caselli: But I, I think that what is going on is that we know that that that is so all the interstellar medium and you know, thanks also to her show, but even before her her her show we knew that the.

231

00:39:22.410 --> 00:39:28.980

Paola Caselli: molecular clouds are highly elementary and you have the old kind of filaments connecting and.

232

00:39:29.490 --> 00:39:37.110

Paola Caselli: Basically, this course, so that that kind of meaning hub, but you know sensitive using a some description, also from field.

233

00:39:37.710 --> 00:39:49.140

Paola Caselli: Work so you have this material that is actually flowing connecting since the audition say this little hub, but that we condense course.

234

00:39:49.650 --> 00:39:58.410

Paola Caselli: To the larger scale, the structure and the saw this is probably what is going on, I mean if this filaments are actually connecting.

235

00:39:58.860 --> 00:40:12.720

Paola Caselli: You know material from the outer part of the cloud or they're less dense material they're bringing in the new stuff for so new say young the chemistry, that is enriching the in this case the inevitable.

236

00:40:13.620 --> 00:40:19.560

Paola Caselli: So it's definitely yeah we This is something that we are doing good I cannot to show it anything yet.

237

00:40:21.660 --> 00:40:31.860

Shmuel Bialy: Okay, so actually I had several questions and I just start with the one that is most connected to the last sentence that you made, and this is.

238

00:40:33.180 --> 00:40:47.040

Shmuel Bialy: What extent the molecules that are forming and How important is it to understand the formation in the is m clouds or most molecules form later later on in the.

239

00:40:48.060 --> 00:40:56.220

Shmuel Bialy: You know, in the denser stages so like do they do, for example, water or other molecule so i've i've walked in water but.

240

00:40:56.550 --> 00:41:07.110

Shmuel Bialy: There are, of course, more complex molecules and when, for example, when I worked on the on on on my walk on water in the early universe, and things like this, I was interested to know whether.

241

00:41:07.740 --> 00:41:22.950

Shmuel Bialy: It is even important or interesting to know the water, it has formed in the is m clouds because in any case, as the cloud collapse may be, then the chemistry initiate itself, and then the molecules forms later so.

242

00:41:24.270 --> 00:41:35.640

Shmuel Bialy: What does it do they mostly form the earliest stages of cloud or already at the later stage, when the stars forming and the planet of forming.

243

00:41:36.210 --> 00:41:42.510

Paola Caselli: Right yeah so the molecule itself for my very early you know these come on.

244

00:41:45.510 --> 00:41:46.050

Shmuel Bialy: there.

245

00:41:46.440 --> 00:41:46.650

But.

246

00:41:47.880 --> 00:41:51.390

Shmuel Bialy: let's say you have a cloud, with no water because let's say Melissa.

247

00:41:52.860 --> 00:42:03.540

Shmuel Bialy: Is is it or you have water that is it matter at all, because one may say it doesn't matter, in any case, one the cloud collapse and then everything.

248

00:42:03.930 --> 00:42:12.750

Paola Caselli: yeah right so well okay so let's assume that the we start the from of what them diffuse cloud let's not go to their one my your nice medium.

249

00:42:13.590 --> 00:42:14.670

Paola Caselli: With the diffuse slot.

250

00:42:15.480 --> 00:42:26.310

Paola Caselli: We started with the diffuse cloud and the you already have actually some chemistry going on, because then we see actually molecules in absorption, if you look at along the line of sight of fraser okay.

251

00:42:26.580 --> 00:42:36.000

Paola Caselli: Definitely, there is some car course is a highly photo dissociated this you have most of the carbon of courses in the class, but you see that you do some chemistry, of course, you make a.

252

00:42:36.750 --> 00:42:44.910

Paola Caselli: vicious very important, so you have H2 indigo in the English diffuse clubs, at least 50% of the hydrogen.

253

00:42:45.510 --> 00:42:57.000

Paola Caselli: But so wasn't and you also have a some chemistry some kind of a change to create two is seen a four month they hide the scene and absorption hcl class a lot of molecules actually even.

254

00:42:57.390 --> 00:43:03.540

Paola Caselli: I saw I saw a paper and not too many years ago about for my mind, which is.

255

00:43:04.080 --> 00:43:07.860

Paola Caselli: complex and Kenny molly I don't know what was going on in this observations, but anyway.

256

00:43:08.220 --> 00:43:18.270

Paola Caselli: That is active chemistry, and I think the you know the surface of the grain, so this amazing ability to have those catalyzing molecules is is just.

257

00:43:18.750 --> 00:43:30.390

Paola Caselli: amazing and you have, and I think what's going on in the cloud so read, is that the best not to just you know uniform diffuse crowd they have again already some kind of substructure and the substructure for money.

258

00:43:30.960 --> 00:43:41.040

Paola Caselli: As you more but to more extent that region, of course, you start to form more molecules in fact here our water because water, you need that to have to be screened by the UV know.

259

00:43:41.430 --> 00:43:47.100

Paola Caselli: interstellar education field, so you start the growing this is mantels and then.

260

00:43:47.700 --> 00:44:01.680

Paola Caselli: Eventually, when it becomes high enough that is this catastrophic seal result, and that is very important because that adds on top of the water a lot, a lot of these carbonaceous material that can be converted.

261

00:44:01.950 --> 00:44:10.380

Paola Caselli: into methanol to can be hydrogenated the optimists and all, and this is the starting point of many of these oxygen building complex organic molecules.

262

00:44:10.830 --> 00:44:22.950

Paola Caselli: So you know it is going with the evolution the end that the other thing that it's interesting is that the the carbon chemistry and the nitrogen canister, for example, that different that they say they have some kind of.

263

00:44:24.030 --> 00:44:25.830

Paola Caselli: Order one order of magnitude.

264

00:44:27.570 --> 00:44:39.660

Paola Caselli: Say out of phase, in a sense of the nitrogen takes longer to form, and this is why you we see these peaks in the nitrogen beating molecules in the dance course that are.

265

00:44:40.170 --> 00:44:53.220

Paola Caselli: You know, particularly dance compared to the surrounding So there is an evolution, so I would say carbon and oxygen molecule for very early, but the day night vision, for example, organic so you need more time.

266

00:44:54.120 --> 00:44:57.840

Shmuel Bialy: It, by the way, meanwhile, I see on dribbled out his race.

267

00:44:58.110 --> 00:45:01.770

Paola Caselli: Yes, I see the hand I and the.

268

00:45:02.580 --> 00:45:03.120

Andrew Burkhardt: Good to see again.

269

00:45:04.290 --> 00:45:04.710

Paola Caselli: let's.

270

00:45:04.830 --> 00:45:14.100

Andrew Burkhardt: Talk yeah I had a couple questions kind of building off a little bit on this, so when you're talking about these you know streaming in of material for example for like HC three an.

271

00:45:15.330 --> 00:45:19.200

Andrew Burkhardt: Infant these large pets theoretically you're also going to be streaming in a.

272

00:45:20.280 --> 00:45:27.540

Andrew Burkhardt: dust and ice in there as well, and theoretically the environments that those ice or for me, are going to be different than the ice.

273

00:45:27.900 --> 00:45:43.290

Andrew Burkhardt: That is close to that these you know kind of protostar you know personal projects be cosmic Ray flux UV flux, or something like that you have any thoughts on how you're kind of enriching a different type of ice chemistry into that scenario as well, and not just the gas.

274

00:45:44.190 --> 00:45:53.190

Paola Caselli: Yes, i'm saying yes, but he I don't know but it's very interesting I, yes I have thought about that in a sense of that that it's definitely true.

275

00:45:53.520 --> 00:46:04.740

Paola Caselli: That it also now we see these longer streamers in class one class to also NHS TAO I think that had been sort of patients, as I remember, now the first author i'm sorry but.

276

00:46:05.190 --> 00:46:23.640

Paola Caselli: There have been observation of streamers so you keep the carrying in material into this stuff screamed and in the later stages so devolution from lower density materials so you keep creating in dust grains, as you said that the will have.

277

00:46:25.800 --> 00:46:39.480

Paola Caselli: ice composition, that that is different from what it has been in the in the end that off of this process starts, so this means that the end we haven't mixture of these so you will have a mixture of.

278

00:46:39.930 --> 00:46:48.270

Paola Caselli: You know, for example, as I said, I didn't talk about dissertation, but you will have an Easter a highly do today that that I don't do today that ISIS.

279

00:46:48.930 --> 00:47:04.320

Paola Caselli: And the fraction of the store with defender on the on the these accretion the how long it is a creation from the cloud the will continue, and of course this will depend on how much material will actually be kept.

280

00:47:04.710 --> 00:47:08.550

Paola Caselli: nearby the star, so I guess you know if you have a big cluster.

281

00:47:09.210 --> 00:47:20.340

Paola Caselli: This motto is blown away so you're stuck on with your original ISIS while if you are in a more quite yes, and the reason you can keep actually are creating this method and and being.

282

00:47:20.640 --> 00:47:27.330

Paola Caselli: actually reached in this carbon chain so which are also very important for prebiotic me see so you know it's all.

283

00:47:28.980 --> 00:47:30.000

Paola Caselli: In a sense.

284

00:47:31.830 --> 00:47:42.990

Paola Caselli: We don't want it to be stuck on the idea that the once you have your core everything is there, and this is the end of the story, and you can build your life.

285

00:47:44.190 --> 00:47:46.830

Paola Caselli: You know your prebiotic molecule from that.

286

00:47:47.460 --> 00:47:52.860

Andrew Burkhardt: yeah That was a that was kind of wondering about that both to do duration side, and also the.

287

00:47:54.090 --> 00:48:03.900

Andrew Burkhardt: That would also probably change the structure of the ice itself, of whether it's personal versus a morphosis bomb that's going to kind of have a lot of effects ask one more question I know there's another one on there.

288

00:48:04.830 --> 00:48:07.620

Shmuel Bialy: Maybe i'll just go to Charlie and then back to you okay.

289

00:48:07.860 --> 00:48:08.160

Thanks.

290

00:48:11.460 --> 00:48:14.370

Shmuel Bialy: hi Charlie we can't hear you can you unmute yourself.

291

00:48:15.960 --> 00:48:17.340

Paola Caselli: Hello john Lee.

292

00:48:17.670 --> 00:48:18.930

Shmuel Bialy: And I think you're still muted.

293

00:48:24.090 --> 00:48:28.740

Shmuel Bialy: We cannot hear you maybe maybe no we can't.

294

00:48:29.820 --> 00:48:31.200

Paola Caselli: But he's not muted.

295

00:48:31.410 --> 00:48:33.570

Shmuel Bialy: it's not me, maybe it's on his computer.

296

00:48:33.570 --> 00:48:34.140

Something.

297

00:48:36.060 --> 00:48:41.490

Shmuel Bialy: On the computer maybe Andrew Whitman and the Maybe you can ask your question, while charlie's trying to fix this.

298

00:48:44.520 --> 00:48:46.620

Shmuel Bialy: fix this and we'll have another question from and.

299

00:48:46.920 --> 00:49:00.150

Andrew Burkhardt: Sure yeah the other questions on this work you're talking about about these this hot protoplanetary disk where you're potentially seeing these sort of different sources shocks, do you have a similar information like what type structure we're talking about I know you mentioned.

300

00:49:01.320 --> 00:49:07.740

Andrew Burkhardt: You know these really high temperatures that would dissolve thermal you describe things off the ice, but obviously also there's gonna be non thermal.

301

00:49:08.550 --> 00:49:18.150

Andrew Burkhardt: desertion processes and other kind of classic shock tracing things going on in there as well, are these like it sort of speed shocks are we talking like see shocks J shocks kind of stuff for.

302

00:49:18.300 --> 00:49:24.330

Paola Caselli: Yes, okay so need to be careful because again.

303

00:49:25.980 --> 00:49:32.220

Paola Caselli: Some of these models said that so these these models simulations of.

304

00:49:33.690 --> 00:49:41.460

Paola Caselli: Self replicating these are actually you know need to make some simplification so to be able to run a.

305

00:49:42.390 --> 00:49:52.440

Paola Caselli: reasonable time and one of these simplification is, in fact, that really on these sharks and because the duty to resolve the shocks, you need to go to super high resolution.

306

00:49:53.160 --> 00:50:01.650

Paola Caselli: Of course, this can be done, but it's not been done yet and i'd be super interested in in doing that, however, I think.

307

00:50:02.520 --> 00:50:12.450

Paola Caselli: So, of course, if you have these shots and if you resolve them, or you can actually look at the stuff during you know the green green collision on, you can have proper ization of grains so which you know we changed.

308

00:50:12.870 --> 00:50:32.670

Paola Caselli: Not drastic we changed the grain size distribution we changed, you know, several properties of the of the diaspora and and guts but the I think it's already clear that if these these exist, and I think we have this proof now with the there is also some other paper actually from.

309

00:50:34.740 --> 00:50:42.960

Paola Caselli: Originally, this this goes observed by our parents and so that is it have former student now is working on that.

310

00:50:43.590 --> 00:50:49.500

Paola Caselli: That it seems that now we have some rules and this says gravitating discrepancy exist.

311

00:50:49.800 --> 00:50:59.640

Paola Caselli: They may not be everywhere in our class zero sources, but in some cases, the end if this is the case, so the temperature is so high that you will anyway get the.

312

00:50:59.940 --> 00:51:08.850

Paola Caselli: Completely evaporation completed operation of the eyes, you mean them evaporate carbon nationals grains because of the suit line it's actually you know.

313

00:51:09.090 --> 00:51:23.520

Paola Caselli: it's the temperature is probably have talking about three 400 kelvin and this temperature seen there, so you may get rid of the carbon russia's material, and this is something I think that we need that to be followed up this so interesting.

314

00:51:24.540 --> 00:51:26.250

Paola Caselli: So much to do, oh my gosh.

315

00:51:26.760 --> 00:51:32.520

Shmuel Bialy: I think, also I will, I hope, i'll have a few minutes to ask you another question this, but first let's see.

316

00:51:33.120 --> 00:51:33.870

Paola Caselli: Charlie can.

317

00:51:34.020 --> 00:51:34.680

Speak.

318

00:51:35.700 --> 00:51:36.780

Oh no.

319

00:51:38.520 --> 00:51:39.570

Shmuel Bialy: Maybe you can type.

320

00:51:42.300 --> 00:51:51.720

Shmuel Bialy: Then I will add narrated if you can type it in the chat and meanwhile i'll just ask a small question then go to carry.

321

00:51:51.840 --> 00:51:52.320

Shmuel Bialy: That is.

322

00:51:52.590 --> 00:52:05.460

Shmuel Bialy: Yes, yep Paula so for the hot desks that you mentioned, you actually showed very high temperatures even like as high as as few as thousand kelvin or I know a few hundred kelvin know.

323

00:52:05.520 --> 00:52:08.520

Paola Caselli: Just 700 kelvin here it is.

324

00:52:08.970 --> 00:52:09.690

Paola Caselli: So.

325

00:52:09.780 --> 00:52:14.670

Paola Caselli: As I said that in there, so in the very Center here don't look at that, too, because.

326

00:52:15.330 --> 00:52:20.040

Paola Caselli: Some numerical problems we have not been resolved, there is some problem.

327

00:52:20.100 --> 00:52:24.000

Paola Caselli: With there is a here and the extra viscosity due to the.

328

00:52:25.650 --> 00:52:44.820

Shmuel Bialy: high temperatures I would expect already neutral chemistry to be efficient and me in some I don't know and maybe excitation of okay at hundred kelvin not but if teachers thousand Calvin even excitation of H<sub>2</sub> and then you might get H<sub>2</sub> lions like infrared lines of molecular hi.

329

00:52:44.820 --> 00:52:49.200

Paola Caselli: Yes, yeah yeah I mean now you have both kind of shocked me see here going on.

330

00:52:50.520 --> 00:52:56.760

Paola Caselli: You know, with this is something definitely do that was this workers, I said venture from isley and.

331

00:52:57.360 --> 00:53:06.960

Paola Caselli: Other people in leads or to my parents did some work on the chemistry in this region, said that yes, you can have a very rich very rich chemistry.

332

00:53:07.590 --> 00:53:16.020

Paola Caselli: Here, and so we are talking about the damper sure that the order of four or 500 kelvin and even higher.

333

00:53:16.800 --> 00:53:35.610

Paola Caselli: So, but let's say three 400 kelvin which is this kind of Nice and number for these couple notches material that it's it's quite interesting, I think this could interest that that Bergen reduce the carbon missing calendar and try to link with the with the earth.

334

00:53:36.720 --> 00:53:38.130

Paola Caselli: Okay sorry, maybe.

335

00:53:38.460 --> 00:53:39.570

Shmuel Bialy: Gary Gary.

336

00:53:39.930 --> 00:53:40.140

Gary Melnick: Oh.

337

00:53:40.200 --> 00:53:40.920

Gary Melnick: Can you hear me.

338

00:53:41.310 --> 00:53:43.050

Paola Caselli: Yes, I can hear you.

339

00:53:43.440 --> 00:53:46.230

Gary Melnick: hi Paul it's great to see you and hear you.

340

00:53:47.730 --> 00:53:49.050

Paola Caselli: I can't see you, though, but.

341

00:53:49.890 --> 00:53:51.450

Gary Melnick: i'm sparing you that.

342

00:53:56.490 --> 00:54:01.980

Gary Melnick: When you have video going sometimes your voice breaks up a little bit because.

343

00:54:02.550 --> 00:54:03.090

Okay.

344

00:54:04.290 --> 00:54:15.240

Gary Melnick: I was wondering if you have, if you have this model in which, for example, the ISIS are some combination of.

345

00:54:16.260 --> 00:54:25.230

Gary Melnick: reprocessing in the desk and material that is freshly brought in from an extended envelope and i'm wondering if you've compared.

346

00:54:26.580 --> 00:54:38.970

Gary Melnick: This model with comments in our own solar system where you know, we do have measures of de de ratios and other compositional information huh.

347

00:54:39.570 --> 00:54:47.040

Paola Caselli: yeah so that's very interesting suggested in fact I think gain a sense to disperse in the same direction as the end the Andrew.

348

00:54:47.460 --> 00:54:54.750

Paola Caselli: question before because, in fact, I mean I saw the answer is no, I have not done that yet.

349

00:54:55.440 --> 00:55:05.880

Paola Caselli: But, indeed, if we can quantify a bit better you know these amount of material that is say in flowing, and this is, as I said, the work in progress.

350

00:55:06.300 --> 00:55:14.220

Paola Caselli: It will be in factor, I think, a very important to do this connection, because we know that there are variations.

351

00:55:14.850 --> 00:55:22.710

Paola Caselli: Between also between comments from the same family, you know Jupiter comment to fit a family or or clap comment.

352

00:55:23.220 --> 00:55:37.380

Paola Caselli: So there is a quite a lot of variation and it'd be nice to see, in fact, if we can understand this mixture just from the point of view, you know this mixing the is from my from different.

353

00:55:38.550 --> 00:55:42.270

Paola Caselli: sources and I guess that if these flows come in.

354

00:55:42.660 --> 00:55:59.280

Paola Caselli: i'm not sure how, when they will mix up the with the rest of the you know of the in an envelope entities, they may even you know just reach locally apart, and so it would be something to do, but I have not done it yet it's a it's a great suggestion.

355

00:55:59.880 --> 00:56:02.340

Gary Melnick: One other thing I mentioned just briefly.

356

00:56:04.320 --> 00:56:15.720

Gary Melnick: I I forget if i've presented this at a conference where you've been in attendance, but we're working on a on a mission right now it's approved and we're in face see.

357

00:56:16.470 --> 00:56:42.630

Gary Melnick: That will look at potentially millions of lines of sight in the Milky Way doing absorption spectroscopy of ISIS So what we hope to do is to establish a very statistically significant evolutionary path between diffuse cloud ICES all the way down to protoplanetary discs so.

358

00:56:44.040 --> 00:56:50.820

Gary Melnick: we'll see if we can realize that in a few years will have these millions of absorption spectrum.

359

00:56:51.150 --> 00:56:55.380

Paola Caselli: yeah that'd be great I mean to have it is what is the name again is this.

360

00:56:55.440 --> 00:56:56.400

The redirects.

361

00:56:57.780 --> 00:57:09.330

Paola Caselli: Yes, yes, so yeah I remember you mentioned that and it's very exciting project, so I really hope that will go through, because then you know we can compare the ice with the gas.

362

00:57:09.930 --> 00:57:11.970

Paola Caselli: Finally, we can constrain.

363

00:57:12.570 --> 00:57:24.270

Paola Caselli: Our chemistry, because you know that that is one of the problems, many molecules actually system, the grains and then we have a

lot of uncertainties and in surface chemistry, so we really need observations of the eyes composition.

364

00:57:24.540 --> 00:57:39.750

Paola Caselli: Of course, and I, we did that, so we hope, also to learn a lot about that the butter having such a in a huge say survey and basically we do survey the galactic plane or.

365

00:57:39.780 --> 00:57:41.010

Gary Melnick: Yes, well, it.

366

00:57:42.960 --> 00:57:54.480

Gary Melnick: just very briefly sphere X will map the entire sky and so when we're not looking at the Milky Way we'll be doing cosmology.

367

00:57:55.530 --> 00:58:02.730

Gary Melnick: we've we will cover the entire Milky Way and what will focus on are those lines of sight.

368

00:58:03.660 --> 00:58:21.030

Gary Melnick: That aren't confused that have you know that don't have multiple background stars within a six architect and pixel and show evidence for a line of sight absorption so that could number in the million, you know, in the few millions.

369

00:58:21.840 --> 00:58:22.380

today.

370

00:58:23.700 --> 00:58:28.410

Gary Melnick: And we're building it, I mean it's not a proposal it's a hardware that's being built.

371

00:58:29.430 --> 00:58:31.020

Paola Caselli: And we fly when.

372

00:58:31.230 --> 00:58:42.300

Gary Melnick: A looks like now, it was a bit we originally were going to fly in 2024 but because of coven related delays, it will probably be in 2025.

373

00:58:43.320 --> 00:58:45.330

Paola Caselli: Okay, so that's really soon.

374

00:58:45.510 --> 00:58:57.150

Shmuel Bialy: Something to to expect for to wait for I think we're almost we're officially done but they're Finally I got the question for Charlie so I thought, maybe.

375

00:59:01.470 --> 00:59:21.480

Shmuel Bialy: That we succeeded, to get a question for Charlie, and that is it charlie's asking for clarification which organic cell phone primarily in gas phase versus on grains for example is the htc and the Jamie sees falling onto the disc formed in gas phase.

376

00:59:22.710 --> 00:59:35.040

Paola Caselli: Right yes that's a good point oh good question Charlie so he said the end that we can reproduce it's chemistry just with Gus face chemistry is there is no need of.

377

00:59:36.150 --> 00:59:36.900

Paola Caselli: Say does.

378

00:59:39.000 --> 00:59:49.020

Paola Caselli: The so to answer your question, I think, in a quick way is that every time you have the saturated molecule so highly hydrogenated with basically.

379

00:59:49.890 --> 01:00:02.580

Paola Caselli: Like water or commodities, a little bit different so sorry, maybe, but, for example, the best example is a methanol methanol, as far as we know.

380

01:00:03.090 --> 01:00:20.040

Paola Caselli: There have been lots of attempts, there is no way that you can afford methanol at the abundance, is that we detect without surface chemistry, so you really need to freezing out and then hydrogen a activities saturated and it is form.

381

01:00:21.840 --> 01:00:36.240

Paola Caselli: And that is the basically the unique route of methanol, there is no gas face, there is a an all through you have to proton ate it, and then we can dissociate and for methanol again but it's not really you know I don't consider that important.

382

01:00:37.290 --> 01:00:56.850

Paola Caselli: And the other one that is very important for the guy so are all these saturated molecule so that contains lots of the hydrogens because the to have a hydrogen many hydrogen atoms and molecules is very inefficient in the gas face, and so you really need to have.

383

01:00:57.960 --> 01:01:04.350

Paola Caselli: In the wild, on the other hand, on the Green surfaces once you have the hydrogen atoms landing on the surface of the grain.

384

01:01:04.710 --> 01:01:13.590

Paola Caselli: It wouldn't be this most efficient thing that ever happened, and you know very fast the fraction of a second it can hydrogenated whatever it can be expression eight.

385

01:01:14.040 --> 01:01:24.690

Paola Caselli: So, for example, water, water, of course, the majority of water is form on the surface of the Games and then of course you can also formulating the gas face that through other.

386

01:01:25.080 --> 01:01:36.480

Paola Caselli: New throw reactions, but that is much less efficient than the surface, so I would say, look at the hydrogen numbers and then say you that will tell you, if that is.

387

01:01:36.900 --> 01:01:46.260

Paola Caselli: Gas or or surface and if you have carbon chain, so that is difficult to form on the surface, because this heavier species, so you have to have multiple carbon.

388

01:01:46.680 --> 01:01:57.690

Paola Caselli: They move much more slowly on the surface, so they actually they are neutral reaction so in this case faster than the surface chemistry, yes, so it's.

389

01:01:58.380 --> 01:02:02.400

Shmuel Bialy: them in the warm in the warm desks, you also have the neutral neutral, the actions which.

390

01:02:02.400 --> 01:02:16.890

Paola Caselli: become you have that actually you have them also the neutral neutral reactions so more or less i'd also present in called the regions, you know about the work that has been done by I mentioned it, that by Shannon and.

391

01:02:18.630 --> 01:02:28.530

Paola Caselli: Well Okay, I have to go back back back up here, so I mentioned the name so here, so this is the Shannon 2013, and this is the group actually.

392

01:02:29.370 --> 01:02:40.350

Paola Caselli: From Leeds I was still there when they did this, it was such an exciting thing, so they found that the right positions of neutral neutral reactions, especially the one with the oh he.

393

01:02:41.730 --> 01:02:57.420

Paola Caselli: actually get that much more saved much faster these reactions at the low temperature because they, there is the two molecules say approach each other, and it is, it is very cool that they form a hydrogen bomb.

394

01:02:58.410 --> 01:03:09.420

Paola Caselli: Complex that that is a long lived enough to actually have the time dealing with the up the hydrogen, of the way and actually form.

395

01:03:10.950 --> 01:03:24.210

Paola Caselli: say a new molecule, and so this is actually very important the discovery that was done in these and then followed up by balcony Scott parodies and other people so it's not just.

396

01:03:24.480 --> 01:03:25.350

Paola Caselli: But, of course, like the.

397

01:03:25.590 --> 01:03:28.200

Shmuel Bialy: high temperature very, very surprising.

398

01:03:28.440 --> 01:03:32.700

Paola Caselli: Yes, yes it's a look at this paper it's beautiful.

399

01:03:34.410 --> 01:03:36.750

Shmuel Bialy: Okay, so I think our time is up on.

400

01:03:37.920 --> 01:03:47.160

Shmuel Bialy: It was very interesting and Paula i'll be happy to continue discussing some of the stuff that I didn't have time to ask during the colloquium.

401

01:03:47.490 --> 01:03:48.810

Paola Caselli: Sure yeah.

402

01:03:49.200 --> 01:03:49.860

Shmuel Bialy: I guess I just.

403

01:03:49.890 --> 01:03:51.660

Shmuel Bialy: want to say everything everyone.

404

01:03:51.690 --> 01:03:53.850

Shmuel Bialy: Thank you so much for coming and.

405

01:03:54.390 --> 01:03:57.120

Paola Caselli: Thank you all for spending one hour.

406

01:03:58.050 --> 01:04:01.260

Paola Caselli: With me and I really hope to see you soon enough for me.

407

01:04:02.160 --> 01:04:08.820

Morgan Elowe MacLeod: Now we're very grateful for you, sharing your time and we know that, overall, just more complicated than ever right now and.

408

01:04:10.140 --> 01:04:11.160

Paola Caselli: Yes, yes.

409

01:04:13.380 --> 01:04:13.800

Morgan Elowe MacLeod: that's right.

410

01:04:14.340 --> 01:04:14.940

Morgan Elowe MacLeod: that's right.

411

01:04:16.110 --> 01:04:27.120

Paola Caselli: that's fantastic, so thank you for the invitation I have to stop the sharing actually otherwise, that you will be stuck okay and see you soon.

412

01:04:27.930 --> 01:04:28.650

Shmuel Bialy: bye bye.

413

01:04:29.190 --> 01:04:34.200

Morgan Elowe MacLeod: Thank you, we want to say thank you to everyone for your time this semester.

414

01:04:38.550 --> 01:04:39.480

Morgan Elowe MacLeod: That was great Thank you.

415

01:04:40.050 --> 01:04:43.020

Shmuel Bialy: Okay Okay, thank you bye.