



1
00:00:00,030 --> 00:00:03,130

[Music]

2
00:00:03,150 --> 00:00:06,380

I'm Conor Nixon, I'm a planetary scientist at NASA's Goddard Space Flight Center,

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00:00:06,400 --> 00:00:09,780

and I study the atmospheric composition of the outer planets.

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00:00:09,800 --> 00:00:13,980

Titan is Saturn's largest moon, it's actually the second-largest moon in the solar system,

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00:00:14,000 --> 00:00:17,880

and it's the only moon in the solar system that has a large and substantial atmosphere,

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00:00:17,900 --> 00:00:24,560

and that atmosphere in some respects is really similar to that of the Earth, being composed mainly of nitrogen,

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00:00:24,580 --> 00:00:29,900

It has methane as the second-most abundant gas, and that takes the same role as water vapor in the Earth's a

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00:00:29,920 --> 00:00:34,120

It evaporates from the surface, it forms clouds, and then rains down again

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00:00:34,140 --> 00:00:40,980

and in fact forms lakes that we see at Titan's north pole, including ethane and propane and all sorts of complex

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00:00:41,000 --> 00:00:48,370

We also see these vast dune fields at the equator, which are not made of silicates as they are on the Earth but

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00:00:48,390 --> 00:00:52,060

essentially plastics which have actually sedimented from the atmosphere

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00:00:52,080 --> 00:00:58,880

and are being blown around into dune fields the same as we'd see on a desert on the Earth.

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00:00:58,900 --> 00:01:03,510

Back in 1980 when Voyager 1 flew by Titan and made the first close encounter with that moon,

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00:01:03,530 --> 00:01:08,280

it discovered many new chemical species in the atmosphere, and a lot of these are what we call hydrocarbons,

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00:01:08,300 --> 00:01:14,890

which are composed of two types of atom, carbon and hydrogen. And these are derived from methane after the

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00:01:14,910 --> 00:01:21,260

it forms into longer and longer chain molecules. So you can add first two carbons together to make a family of

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00:01:21,280 --> 00:01:27,050

and you can also form three carbons together to form a heavier family of molecules.

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00:01:27,070 --> 00:01:33,020

So it was actually very mysterious that Voyager only discovered the heaviest and the lightest members of the

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00:01:33,040 --> 00:01:38,610

but it didn't find the middle member of the family, propylene, that was missing.

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00:01:38,630 --> 00:01:43,600

So NASA has this wonderful flagship spacecraft called Cassini which is currently orbiting Saturn,

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00:01:43,620 --> 00:01:50,730

and it's making multiple close flybys of Titan. Now in visible light, Titan appears quite bland and featureless just

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00:01:50,750 --> 00:01:55,580

but Cassini has techniques to peer through that haze, including the Composite Infrared Spectrometer or CIRS,

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00:01:55,600 --> 00:02:00,900

which can look at the heat coming from the atmosphere and split it apart into its different frequencies,

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00:02:00,920 --> 00:02:06,660

and this forms a characteristic pattern of peaks, which give the characteristic signatures of different molecules.

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00:02:06,680 --> 00:02:13,060

And through this we can detect which molecules are in the atmosphere, and we see all the molecules that were

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00:02:13,080 --> 00:02:19,110

But we're also able to look for new molecules, and in fact, buried within the signatures of these more abundant

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00:02:19,130 --> 00:02:24,260

we saw a very small spike which was due to a new species which had not been seen before,

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00:02:24,280 --> 00:02:29,060

and in fact this was propylene, and we saw it at multiple altitudes in Titan's atmosphere.

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00:02:29,080 --> 00:02:34,300

When we added all the signal together, we had more than 99% confidence that we were discovering a new mo

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00:02:34,320 --> 00:02:38,630

[Music, wind blowing]

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00:02:38,650 --> 00:02:42,690

So this object I have right here, this is polypropylene.

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00:02:42,710 --> 00:02:48,730

This is a plastic that we use on the Earth in everyday household objects such as this plastic tub here,

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00:02:48,750 --> 00:02:54,910

and if we turn it over on the bottom, we find a symbol with the number 5 that says PP, polypropylene.

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00:02:54,930 --> 00:03:00,880

This is the propylene that we found on Titan, but polymerized, that means that the molecule is formed into long

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00:03:00,900 --> 00:03:06,080

and when these chains are tangled together it forms a hard, clear plastic that we use in many household objects

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00:03:06,100 --> 00:03:13,280

So that was really fun for me to realize that something that we'd discovered in space was in fact something that

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00:03:13,300 --> 00:03:16,360

So the discovery of propylene on Titan is really exciting.

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00:03:16,380 --> 00:03:23,310

First of all, it completes this chemical family where we had this missing link dating thirty-two years back to Voya

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00:03:23,330 --> 00:03:27,680

but also, it shows that there's much more there still in Titan's atmosphere to be discovered.

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00:03:27,700 --> 00:03:34,740

Some people think that Titan is similar to the prebiotic Earth long ago, when the molecules were forming the ba

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00:03:34,760 --> 00:03:40,580

And we don't know what we're going to find on Titan if we send back further spacecraft with new instruments, n