1
00:00:00,010 --> 00:00:07,160
[music]

2
00:00:07,180 --> 00:00:10,780
There are two types of ice that you find in the solar system.

3
00:00:10,800 --> 00:00:13,680
There's the crystalline ice that you will find in your freezer,

4
00:00:13,700 --> 00:00:16,170
but there is also a type of ice called amorphous

5
00:00:16,190 --> 00:00:19,680
which lacks a regular geometrical pattern for its molecules.

6
00:00:19,700 --> 00:00:23,400
Amorphous ice is not something you naturally find on Earth

7
00:00:23,420 --> 00:00:26,530
because the temperatures and pressures are much higher on Earth.

8
00:00:26,550 --> 00:00:30,580
The way that we make our ice is we use a small evacuated chamber,

9
00:00:30,600 --> 00:00:31,960
we pump all the air out,

10
00:00:31,980 --> 00:00:34,930
we have a small metal disk about the size of a quarter

11
00:00:34,950 --> 00:00:37,950
that we cool down to just a few degrees above absolute zero,

12
00:00:37,970 --> 00:00:41,210
we flow a gas on top of it, the gas freezes on the metal,

13
00:00:41,230 --> 00:00:46,190

and we can study the way light reflects off that metal to tell us what the ice is like.

14
00:00:46,210 --> 00:00:49,280
One of the things that makes our lab unique

15
00:00:49,300 --> 00:00:54,630
is that we can study cosmic ices when they're exposed to high energy protons

16
00:00:54,650 --> 00:00:57,130
from a Van de Graff accelerator,

17
00:00:57,150 --> 00:01:02,940
so we can bombard our ices with protons that have a million volts of energy.

18
00:01:02,960 --> 00:01:08,480
The data that we measure can be used in order to interpret observations

19
00:01:08,500 --> 00:01:12,070
that astronomers make of cosmic ices in space.

20
00:01:12,090 --> 00:01:16,110
Most people would put compounds in liquid water at room temperature

21
00:01:16,130 --> 00:01:19,150
and study the chemistry like that, but

22
00:01:19,170 --> 00:01:22,980
we're studying the chemistry in ice at extremely low temperatures.

23
00:01:23,000 --> 00:01:27,580
Historically people may not have thought that there could be any chemistry at those temperatures.

24
00:01:27,600 --> 00:01:31,670
We're able to study things in space without leaving the laboratory.

25
00:01:31,690 --> 00:01:36,520
At NASA we have people who build spacecraft and fly to distant places in the solar system.

26
00:01:36,540 --> 00:01:40,570
We collaborate with them, and by combining the laboratory work we do with

27
00:01:40,590 --> 00:01:43,080
the spacecraft work that NASA does so well,

28
00:01:43,100 --> 00:01:45,430
we're able to actually study the chemical composition

29
00:01:45,450 --> 00:01:48,910
of things throughout the solar system and in some cases throughout the galaxy.