1
00:00:00,360 --> 00:00:03,030
Houston, station on two.

2
00:00:03,030 --> 00:00:07,810
I'm Don Pettit.

3
00:00:07,810 --> 00:00:10,270
I'm on the International Space Station,

4
00:00:10,270 --> 00:00:18,130
and I'm going to show you some interesting
observations about water sheets.

5
00:00:18,130 --> 00:00:21,480
Here in a weightless environment
on the International Space Station,

6
00:00:21,480 --> 00:00:25,800
you can make films of pure water.

7
00:00:25,800 --> 00:00:32,280
It's like trying to draw, stick a loop, in
a bottle of water and pulling out a film.

8
00:00:32,280 --> 00:00:35,250
You just can't do that on Earth.

9
00:00:35,250 --> 00:00:37,040
You have to have soap.

10
00:00:37,040 --> 00:00:41,780
And I'm going to use a number of different
geometries, a number of different kinds

11
00:00:41,780 --> 00:00:46,700
of loops, and a number of different
experiments with these water films.

12

00:00:46,700 --> 00:00:52,300
So you can look for example at
diffusion in water, say a food coloring

13
00:00:52,300 --> 00:00:54,850
or any other substance you want in water.

14
00:00:54,850 --> 00:00:58,160
You can look at the diffusion
in a two dimensional sheet.

15
00:00:58,160 --> 00:01:03,050
Because these water sheets are
so thin, convection perpendicular

16
00:01:03,050 --> 00:01:09,110
to the sheet will not be a factor,
and you can just look at fluid motion

17
00:01:09,110 --> 00:01:11,310
within the plane of the water sheet.

18
00:01:11,310 --> 00:01:15,440
So here I put a drop of blue food
coloring, a drop of red food coloring,

19
00:01:15,440 --> 00:01:19,960
and a drop of green food coloring, and
then you give it a little puff of air.

20
00:01:19,960 --> 00:01:29,140
And the viscous forces in these thin sheets
are small compared to the fluid motion,

21
00:01:29,140 --> 00:01:35,450
so they will continue to spin
like this for five or ten minutes

22
00:01:35,450 --> 00:01:40,380
until the viscous forces will

eventually have them slow down.

23
00:01:40,380 --> 00:01:47,190
And the food coloring will get
stretched out and leave streak lines.

24
00:01:47,190 --> 00:01:53,900
And if you do too much convection in here
then you end up with just this black sheet.

25
00:01:53,900 --> 00:01:58,590
Here's another water sheet
example, and this one is thin.

26
00:01:58,590 --> 00:02:01,300
This one is about 200 microns thick.

27
00:02:01,300 --> 00:02:04,060
And again I'm putting red food coloring on.

28
00:02:04,060 --> 00:02:08,210
And when you put a drop of red food
coloring on, notice those little vortices,

29
00:02:08,210 --> 00:02:10,960
those little swirls that kind
of look like mushroom caps.

30
00:02:10,960 --> 00:02:16,320
Really what you're seeing is a
cross section through a vortex ring.

31
00:02:16,320 --> 00:02:18,850
And here I'm going to put a little puff of air.

32
00:02:18,850 --> 00:02:23,210
I'm going to generate another
two-dimensional equivalent of a vortex ring.

33

00:02:23,210 --> 00:02:29,340
And again it looks more like a mushroom cap,
but this is what a vortex ring would look

34
00:02:29,340 --> 00:02:31,350
like if you were able to
take a slice through it.

35
00:02:31,350 --> 00:02:36,990
And now I've got a sheet that's about ...

36
00:02:36,990 --> 00:02:41,480
actually it's a little thinner than
the wire now that's suspending it.

37
00:02:41,480 --> 00:02:46,250
You can see if these things are slightly
convex that means they're thicker in the middle

38
00:02:46,250 --> 00:02:50,910
than at the edges, it makes a convex
lens and it's a positive lens.

39
00:02:50,910 --> 00:02:56,560
If they're slightly concave, then, which means
it's thinner in the middle than at the edges,

40
00:02:56,560 --> 00:03:01,560
it makes a negative lens,
so things look smaller.

41
00:03:01,560 --> 00:03:05,500
And this one is actually pretty much parallel.

42
00:03:05,500 --> 00:03:08,000
It doesn't seem to make my face there...

43
00:03:08,000 --> 00:03:11,280
Actually, I think it makes me look better!