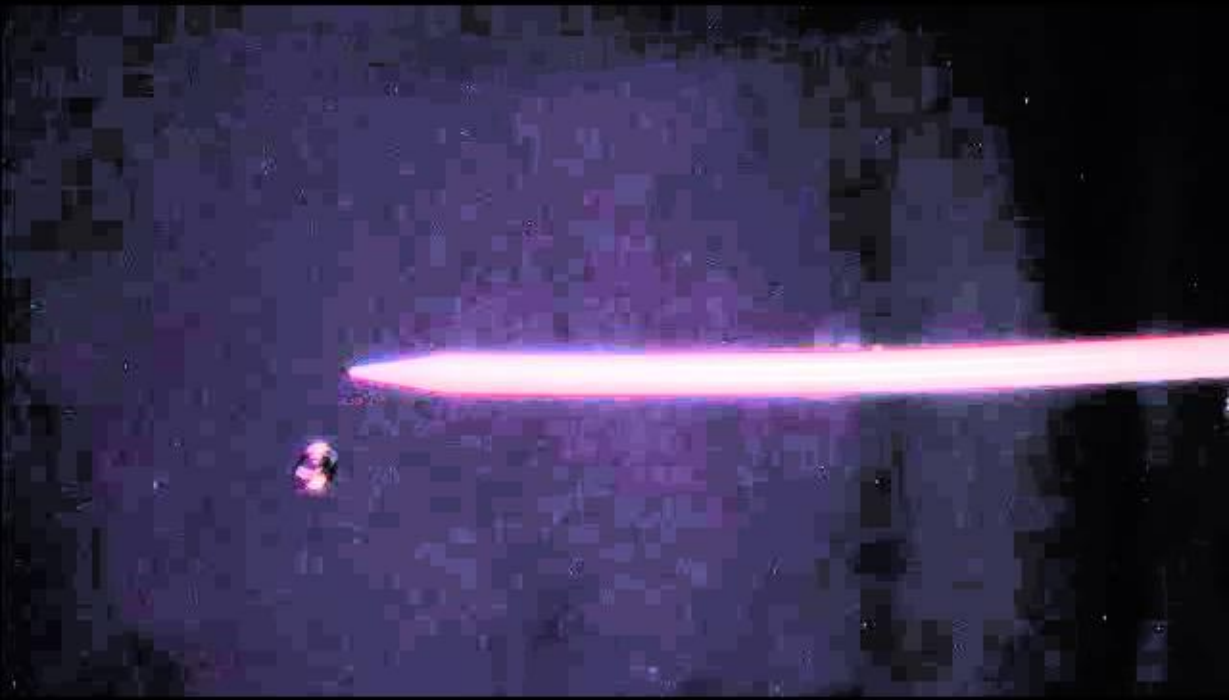

1
00:00:04,600 --> 00:00:09,960
Okay I've got it on pause. And what you're
looking at is a knitting needle. And I happen

2
00:00:09,960 --> 00:00:17,160
to have in my crew preference a couple of
knitting needles. And not that we have a lot

3
00:00:17,160 --> 00:00:21,460
of time to do knitting up here, but there's
some other neat things you can do with them.

4
00:00:21,460 --> 00:00:28,530
And so, watch this.
So, here I have a piece of paper, and I rub

5
00:00:28,530 --> 00:00:33,070
the knitting needle with a piece of paper.
And this knitting needle is a polyethylene

6
00:00:33,070 --> 00:00:38,219
knitting needle. It's 8 mm in diameter.
And now I'm going to take a syringe with

7
00:00:38,219 --> 00:00:43,629
a little Teflon cannula, I'm going to squirt
drops of water out, and look what happens

8
00:00:43,629 --> 00:00:47,929
when those drops of water get close to that
charged knitting needle.

9
00:00:47,929 --> 00:00:59,309
So this is like a little satellite going around
a cylindrical shaped planet. Except the physics

10
00:00:59,309 --> 00:01:04,500
here is a little bit different. It's not
about gravitation; it's about charge forces.

11
00:01:04,500 --> 00:01:10,240
And of course charges can exert a potential
field as we call it, so it can exert a force

12
00:01:10,240 --> 00:01:16,390
at a distance with no tangible connection,
and so you have a charged drop that was ejected

13
00:01:16,390 --> 00:01:24,750
from the Teflon tipped syringe. And then you
have the charged knitting needle, and they're

14
00:01:24,750 --> 00:01:31,469
going to be attracted if they're opposite
charges. But because the drop has some velocity

15
00:01:31,469 --> 00:01:35,520
to it, it's orbiting around the knitting
needle.

16
00:01:35,520 --> 00:01:41,850
Now this knitting needle happens to be a little
different than the one we started out. This

17
00:01:41,850 --> 00:01:48,119
knitting needle is made out of Teflon. And
Teflon has some really neat static charging

18
00:01:48,119 --> 00:01:52,409
properties when you rub it. And I figured
it would be good to have a Teflon knitting

19
00:01:52,409 --> 00:01:57,469
needle when you're on station.
Now look at this droplet. It's orbiting

20
00:01:57,469 --> 00:02:04,150
around and since we have cylindrical geometry
here, it can precess down the cylinder, but

21
00:02:04,150 --> 00:02:09,500
then it gets to the end and it reverses its
direction and winds back along the cylinder

22
00:02:09,500 --> 00:02:12,930
so it seems to be trapped.
And here we have some little tiny droplets.

23
00:02:12,930 --> 00:02:18,730
They kind of remind me of flies on a picnic
out in Houston.

24
00:02:18,730 --> 00:02:29,390
And these droplets, the bigger ones that you're
seeing there are about 6 to 7 mm. That Teflon

25
00:02:29,390 --> 00:02:37,180
rod is about 6 ½ mm in diameter.
And then here you see a bunch of little tiny

26
00:02:37,180 --> 00:02:42,780
droplets, and they're making spirals. And
they go down the cylinder for awhile and then

27
00:02:42,780 --> 00:02:44,900
they'll reverse their direction and spiral
back.

28
00:02:44,900 --> 00:02:49,630
Now if you'll look closely up in the upper
right-hand corner you'll see the injection

29
00:02:49,630 --> 00:02:54,010
nozzle from the syringe, and you'll also
see that I have a second knitting needle.

30
00:02:54,010 --> 00:02:58,920
Actually a third knitting needle, and that
knitting needle is made out of nylon. And

31
00:02:58,920 --> 00:03:04,820
so you can rub the nylon, you can rub the
Teflon, and there's some interesting charge

32
00:03:04,820 --> 00:03:12,330
properties that happen between Teflon and
nylon. And I found that it's useful to have

33
00:03:12,330 --> 00:03:25,030
these when you want to put a charge on a droplet
so it will orbit your knitting needle.

34
00:03:25,030 --> 00:03:29,840
There you can see the tip of the nylon knitting
needle that I charged up with the same piece

35
00:03:29,840 --> 00:03:41,550
of paper type of rubbing.
Now this might also have some physics analogies

36
00:03:41,550 --> 00:03:46,020
to what happens with charged particles when
they come down Earth's magnetic field. Again,

37
00:03:46,020 --> 00:03:51,140
the physics here's a little different, but
the fact that you have charged solar particles

38
00:03:51,140 --> 00:03:56,480
spiraling down Earth's magnetic field, sometimes
hitting different layers in the atmosphere,

39
00:03:56,480 --> 00:04:03,450
reflecting off and going back, spiraling back
along the magnetic field line. And again this

40
00:04:03,450 --> 00:04:12,470
is charged, but the behavior has analogous
implications to what might be happening in

41
00:04:12,470 --> 00:04:19,259
Earth’s magnetic field with charged particles,
and this of course is one of the key players

42
00:04:19,259 --> 00:04:26,670
to giving us our aurora.
And of course once you set up a knitting needle

43
00:04:26,670 --> 00:04:32,010
like this, you start to play with the water
droplets, you just can’t have too much video

44
00:04:32,010 --> 00:04:37,870
like this. It is so much fun to watch these
little droplets, and notice as they get closer

45
00:04:37,870 --> 00:04:45,930
and closer to the knitting needle, their orbits
go faster and faster. And the further away

46
00:04:45,930 --> 00:04:49,710
from the knitting needle, the slower the orbit.
The closer to the knitting needle, the faster

47
00:04:49,710 --> 00:04:53,340
the orbit. And that’s the same thing with
orbital mechanics when you have a satellite

48
00:04:53,340 --> 00:04:58,190
around a planet. And again, the physics is
different. Planets… satellites orbiting

49
00:04:58,190 --> 00:05:05,750
planets is a gravitational potential, gravitational
forces, and this is static electric potentials