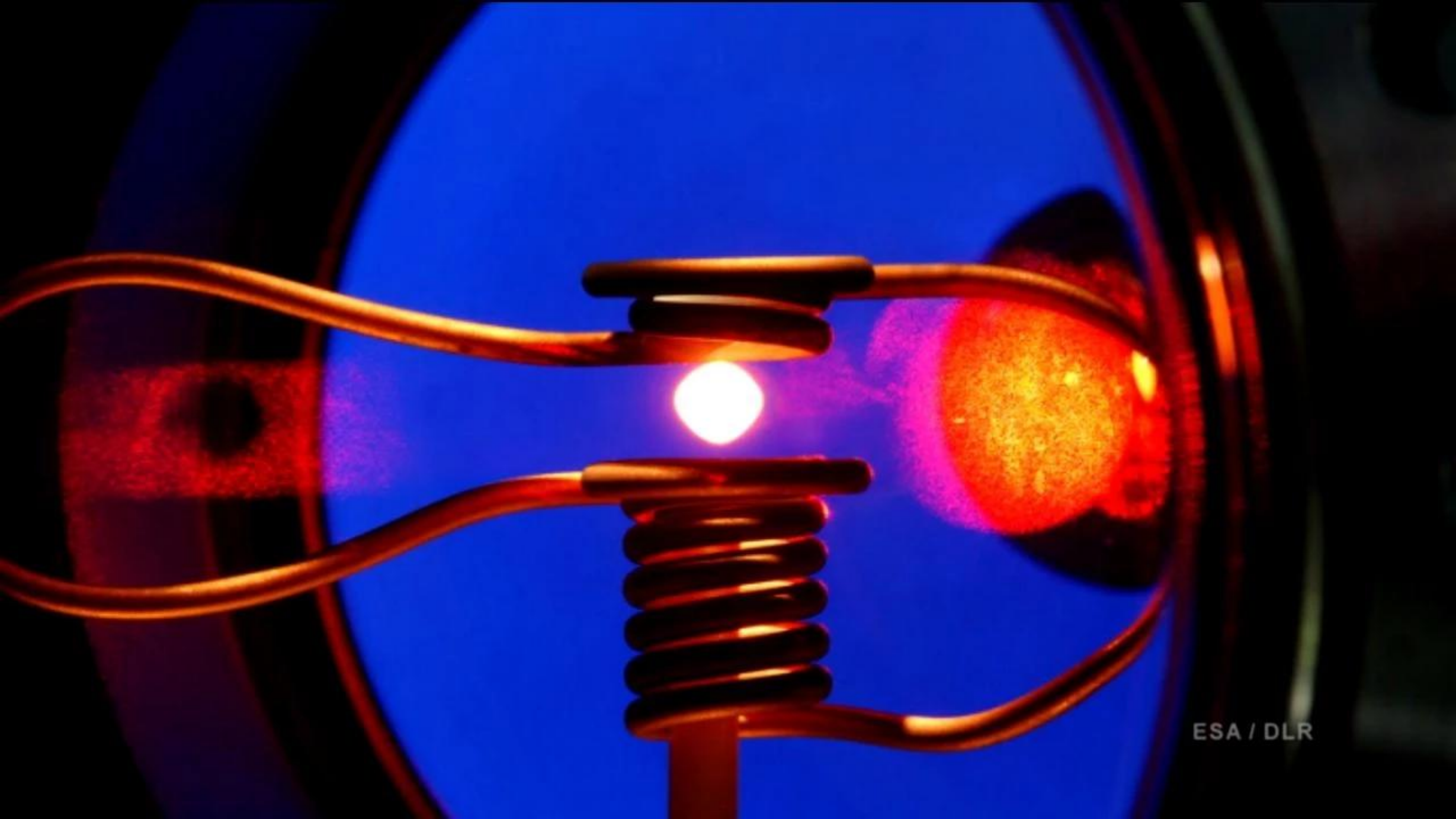
ESA / DLR

1
00:00:07,670 --> 00:00:05,910
material sciences are one of the major

2
00:00:09,669 --> 00:00:07,680
areas of laboratory research that the

3
00:00:11,669 --> 00:00:09,679
international space station supports and

4
00:00:13,990 --> 00:00:11,679
a new instrument from the european space

5
00:00:16,070 --> 00:00:14,000
agency is just being put into operation

6
00:00:17,830 --> 00:00:16,080
in that area the electromagnetic

7
00:00:20,150 --> 00:00:17,840
levitator was delivered to the station

8
00:00:21,910 --> 00:00:20,160
last year on the last automated transfer

9
00:00:23,910 --> 00:00:21,920
vehicle and set up in the columbus

10
00:00:26,790 --> 00:00:23,920
laboratory module and is being prepared

11
00:00:29,429 --> 00:00:26,800
for its first operations i spoke with dr

12
00:00:31,189 --> 00:00:29,439
douglas matson an associate professor of

13
00:00:33,990 --> 00:00:31,199

mechanical engineering at tufts

14
00:00:36,069 --> 00:00:34,000
university who serves as the eml's u.s

15
00:00:37,590 --> 00:00:36,079
facility scientist and as a speaker of

16
00:00:39,190 --> 00:00:37,600
the international working group

17
00:00:41,510 --> 00:00:39,200
representing all scientists doing

18
00:00:43,430 --> 00:00:41,520
research with eml i asked them to start

19
00:00:45,670 --> 00:00:43,440
by describing this new facility and tell

20
00:00:47,990 --> 00:00:45,680
me what it's capable of doing

21
00:00:50,549 --> 00:00:48,000
the electromagnetic levitator

22
00:00:53,430 --> 00:00:50,559
involves passing a high frequency

23
00:00:55,910 --> 00:00:53,440
current through copper cooled coils

24
00:00:56,709 --> 00:00:55,920
this current generates a magnetic field

25
00:00:59,830 --> 00:00:56,719
which

26
00:01:01,990 --> 00:00:59,840
causes the sample to levitate without

27
00:01:04,070 --> 00:01:02,000
touching anything therefore we can

28
00:01:06,630 --> 00:01:04,080
process samples of

29
00:01:08,789 --> 00:01:06,640
metallic substances in a very clean

30
00:01:09,910 --> 00:01:08,799
environment

31
00:01:15,030 --> 00:01:09,920
with

32
00:01:18,390 --> 00:01:15,040
chamber so what we look at is

33
00:01:21,109 --> 00:01:18,400
we look at how metals solidify

34
00:01:23,670 --> 00:01:21,119
how what the thermophysical properties

35
00:01:27,190 --> 00:01:23,680
are of those metals so that we can do

36
00:01:30,390 --> 00:01:27,200
process modeling here on earth and we

37
00:01:32,710 --> 00:01:30,400
look at the kinetics of the process you

38
00:01:34,310 --> 00:01:32,720

know how do you change from

39
00:01:36,710 --> 00:01:34,320
one uh

40
00:01:38,630 --> 00:01:36,720
crystalline structure to another

41
00:01:40,230 --> 00:01:38,640
so tell me why is it valuable for

42
00:01:42,389 --> 00:01:40,240
scientists to study the behavior of

43
00:01:44,389 --> 00:01:42,399
metals in the weightlessness

44
00:01:47,510 --> 00:01:44,399
the weightless environment allows us to

45
00:01:48,950 --> 00:01:47,520
do things that we can't do here on earth

46
00:01:51,910 --> 00:01:48,960
specifically

47
00:01:54,310 --> 00:01:51,920
the since the sample is levitated here

48
00:01:56,950 --> 00:01:54,320
on earth that means it's the sample

49
00:01:57,990 --> 00:01:56,960
itself is pulled down into the sample

50
00:01:58,709 --> 00:01:58,000
coils

51
00:02:01,350 --> 00:01:58,719
now

52
00:02:04,230 --> 00:02:01,360
therefore that creates a lot of stirring

53
00:02:05,510 --> 00:02:04,240
within the sample which is not what we'd

54
00:02:08,389 --> 00:02:05,520
like to have we'd like to have a

55
00:02:11,430 --> 00:02:08,399
quiescent sample so that we understand

56
00:02:14,070 --> 00:02:11,440
what is happening to the liquid itself

57
00:02:16,390 --> 00:02:14,080
so therefore in microgravity since the

58
00:02:19,430 --> 00:02:16,400
sample's not its weight doesn't have to

59
00:02:21,830 --> 00:02:19,440
be overcome you can use a lot less

60
00:02:24,070 --> 00:02:21,840
magnetic force and therefore a lot less

61
00:02:25,670 --> 00:02:24,080
stirring occurs so you can look at a

62
00:02:27,670 --> 00:02:25,680
quiescent drop

63
00:02:30,070 --> 00:02:27,680

take a look at its properties and get

64
00:02:32,869 --> 00:02:30,080
much better thermophysical properties or

65
00:02:35,190 --> 00:02:32,879
much better understanding of how the

66
00:02:37,670 --> 00:02:35,200
droplet solidifies the other thing we

67
00:02:39,589 --> 00:02:37,680
can do is we can look at how does

68
00:02:41,830 --> 00:02:39,599
stirring influence

69
00:02:44,790 --> 00:02:41,840
how solidification occurs

70
00:02:46,550 --> 00:02:44,800
so this is uh something that's both the

71
00:02:48,550 --> 00:02:46,560
thermophysical properties and the

72
00:02:51,110 --> 00:02:48,560
influence of convection

73
00:02:54,070 --> 00:02:51,120
are extremely important for process

74
00:02:56,630 --> 00:02:54,080
modeling for processes here on earth so

75
00:03:00,070 --> 00:02:56,640
it's not that we're solidifying a sample

76
00:03:02,229 --> 00:03:00,080
in zero gravity it's more that we have

77
00:03:05,270 --> 00:03:02,239
better experimental control

78
00:03:07,750 --> 00:03:05,280
in order to provide better properties

79
00:03:10,630 --> 00:03:07,760
and the better ability for people to

80
00:03:13,270 --> 00:03:10,640
model earthbound processes

81
00:03:15,430 --> 00:03:13,280
uh and therefore uh create

82
00:03:17,750 --> 00:03:15,440
much better process control

83
00:03:19,030 --> 00:03:17,760
with higher quality products here on

84
00:03:20,949 --> 00:03:19,040
earth

85
00:03:23,270 --> 00:03:20,959
what is the role of the astronauts on

86
00:03:27,110 --> 00:03:23,280
the station during the experiments

87
00:03:29,430 --> 00:03:27,120
using the electromagnetic levitator

88
00:03:31,910 --> 00:03:29,440

the astronauts role is to act as our

89
00:03:34,630 --> 00:03:31,920
hands and our eyes

90
00:03:37,830 --> 00:03:34,640
they do a lot of the equipment

91
00:03:38,630 --> 00:03:37,840
monitoring they install the facility

92
00:03:41,110 --> 00:03:38,640
when

93
00:03:44,070 --> 00:03:41,120
we take our samples from ground and

94
00:03:47,830 --> 00:03:44,080
bring them to our facility it comes in a

95
00:03:50,070 --> 00:03:47,840
big giant box called a sample carousel

96
00:03:52,070 --> 00:03:50,080
it's a carousel because the samples spin

97
00:03:54,309 --> 00:03:52,080
on this inside this box

98
00:03:56,630 --> 00:03:54,319
and so there's 18 samples that are going

99
00:03:58,550 --> 00:03:56,640
to be processed at any one time

100
00:04:00,789 --> 00:03:58,560
we have multiple times that we're going

101
00:04:03,509 --> 00:04:00,799
to be bringing different carousels up so

102
00:04:05,589 --> 00:04:03,519
the astronauts install our samples on

103
00:04:08,149 --> 00:04:05,599
our facility and then

104
00:04:10,470 --> 00:04:08,159
safely pack up the samples so that they

105
00:04:13,509 --> 00:04:10,480
can be brought back here to earth so we

106
00:04:15,990 --> 00:04:13,519
can study how the samples solidified and

107
00:04:18,550 --> 00:04:16,000
what kind of structures we have formed

108
00:04:20,710 --> 00:04:18,560
during their solidification on orbit the

109
00:04:23,350 --> 00:04:20,720
other thing that the astronauts do is

110
00:04:25,430 --> 00:04:23,360
they go in and they will

111
00:04:27,510 --> 00:04:25,440
change out equipment that we need for a

112
00:04:29,030 --> 00:04:27,520
specific experiment

113
00:04:30,469 --> 00:04:29,040

for instance we have two different

114
00:04:32,870 --> 00:04:30,479
camera systems

115
00:04:35,830 --> 00:04:32,880
one that has very high spatial

116
00:04:38,230 --> 00:04:35,840
resolution so we can see fine details

117
00:04:40,070 --> 00:04:38,240
and one that goes extremely fast so that

118
00:04:41,590 --> 00:04:40,080
we can look at processes that occur

119
00:04:44,150 --> 00:04:41,600
quickly

120
00:04:47,189 --> 00:04:44,160
in order to change out these cameras we

121
00:04:49,670 --> 00:04:47,199
need to have the astronauts go in and as

122
00:04:53,030 --> 00:04:49,680
a matter of fact during a past shuttle

123
00:04:54,950 --> 00:04:53,040
mission during my experiment

124
00:04:57,670 --> 00:04:54,960
the cameras stopped working and the

125
00:05:00,310 --> 00:04:57,680
astronauts had to go in

126
00:05:02,070 --> 00:05:00,320
check the system out they found that one

127
00:05:04,230 --> 00:05:02,080
of the cables was malfunctioning and

128
00:05:06,710 --> 00:05:04,240
they were able to change that cable out

129
00:05:09,029 --> 00:05:06,720
and allow me to do my experiments so the

130
00:05:11,430 --> 00:05:09,039
astronauts do a lot for us can you give

131
00:05:13,270 --> 00:05:11,440
me some examples of some of the science

132
00:05:15,350 --> 00:05:13,280
experiment runs that you have planned

133
00:05:16,870 --> 00:05:15,360
for the astronauts on station

134
00:05:18,230 --> 00:05:16,880
all right we have uh

135
00:05:22,230 --> 00:05:18,240
many different international

136
00:05:25,029 --> 00:05:22,240
collaborations on our using our facility

137
00:05:27,990 --> 00:05:25,039
where one of the projects is looking at

138
00:05:29,909 --> 00:05:28,000

thermophysical properties and

139
00:05:33,110 --> 00:05:29,919
how we could use those properties than

140
00:05:36,310 --> 00:05:33,120
in ma in process modeling here on earth

141
00:05:38,150 --> 00:05:36,320
we have a project on sedimentation

142
00:05:39,110 --> 00:05:38,160
looking at demixing and interfacial

143
00:05:40,790 --> 00:05:39,120
tension

144
00:05:44,230 --> 00:05:40,800
one on development of composite

145
00:05:45,990 --> 00:05:44,240
structures one on magnetic materials

146
00:05:47,830 --> 00:05:46,000
and development of turbine blade

147
00:05:49,830 --> 00:05:47,840
materials

148
00:05:53,510 --> 00:05:49,840
finally we have one looking at

149
00:05:56,550 --> 00:05:53,520
icosahedral order and quasi-crystal

150
00:05:59,350 --> 00:05:56,560
formation so we have a multiple array of

151
00:06:00,629 --> 00:05:59,360
many different projects there involved

152
00:06:03,029 --> 00:06:00,639
looking at

153
00:06:05,430 --> 00:06:03,039
how metals solidify

154
00:06:07,590 --> 00:06:05,440
differently depending on what their

155
00:06:09,510 --> 00:06:07,600
composition is how many researchers

156
00:06:11,670 --> 00:06:09,520
around the world are actually using this

157
00:06:16,469 --> 00:06:11,680
hardware that you have

158
00:06:19,590 --> 00:06:16,479
currently we have 14 european teams

159
00:06:22,469 --> 00:06:19,600
four u.s teams collaborating with them

160
00:06:24,870 --> 00:06:22,479
one canadian team and i believe three

161
00:06:25,749 --> 00:06:24,880
asian teams

162
00:06:28,070 --> 00:06:25,759
so

163
00:06:30,710 --> 00:06:28,080

that involves about 50 scientists

164
00:06:33,670 --> 00:06:30,720
worldwide we also have a rather large

165
00:06:35,029 --> 00:06:33,680
support structure and from esa

166
00:06:39,110 --> 00:06:35,039
and from

167
00:06:41,350 --> 00:06:39,120
nasa and the japanese space agency jaxa

168
00:06:44,629 --> 00:06:41,360
and the german space agency

169
00:06:45,990 --> 00:06:44,639
and uh airbus a uh a

170
00:06:48,390 --> 00:06:46,000
those are the people who actually build

171
00:06:50,790 --> 00:06:48,400
the facility so it's over 100 people who

172
00:06:52,629 --> 00:06:50,800
are involved with this project

173
00:06:54,390 --> 00:06:52,639
thank you for your time today and uh

174
00:06:55,670 --> 00:06:54,400
explaining all of the science that's

175
00:06:57,270 --> 00:06:55,680
going on and all the work that you're