



**SPACESTATION  
LIVE**

1  
00:00:09,920 --> 00:00:08,330  
the Cana Tory transport vehicle carrying

2  
00:00:11,690 --> 00:00:09,930  
supplies to the International Space

3  
00:00:14,620 --> 00:00:11,700  
Station is carrying a lot of supplies

4  
00:00:16,550 --> 00:00:14,630  
for science onboard including a large

5  
00:00:19,939 --> 00:00:16,560  
astrophysics mission coming up

6  
00:00:22,700 --> 00:00:19,949  
unpressurized on the exposed pallet the

7  
00:00:25,519 --> 00:00:22,710  
colorimetric electron telescope known as

8  
00:00:28,700 --> 00:00:25,529  
colette is destined for the outboard end

9  
00:00:31,189 --> 00:00:28,710  
of Kibo out on the exposed facility for

10  
00:00:33,770 --> 00:00:31,199  
a study of high-energy cosmic rays and

11  
00:00:36,380 --> 00:00:33,780  
today we learn more about that from dr.

12  
00:00:38,270 --> 00:00:36,390  
John waffle he's a professor emeritus at

13  
00:00:40,610 --> 00:00:38,280

Louisiana State University's Department

14

00:00:42,889 --> 00:00:40,620  
of physics and astronomy and a

15

00:00:45,650 --> 00:00:42,899  
co-investigator on the Colet team that's

16

00:00:49,099 --> 00:00:45,660  
led by dr. Shoji Torre of Waseda

17

00:00:51,259 --> 00:00:49,109  
University in Japan explained to us how

18

00:00:53,930 --> 00:00:51,269  
this telescope works I mean how does it

19

00:00:56,540 --> 00:00:53,940  
go about searching for cosmic rays

20

00:00:59,360 --> 00:00:56,550  
okay well cosmic rays come at you from

21

00:01:01,399 --> 00:00:59,370  
all directions and all the time because

22

00:01:04,100 --> 00:01:01,409  
they may originate outside our solar

23

00:01:08,210 --> 00:01:04,110  
system elsewhere in the galaxy so what

24

00:01:11,360 --> 00:01:08,220  
we basically do is sit there and just

25

00:01:14,270 --> 00:01:11,370  
look so it's a long exposure every time

26

00:01:17,320 --> 00:01:14,280

one of these high-energy cosmic rays

27

00:01:19,880 --> 00:01:17,330

comes at us and it starts triggering the

28

00:01:23,120 --> 00:01:19,890

instrument and we were then we record it

29

00:01:26,650 --> 00:01:23,130

add it to the data set and eventually we

30

00:01:29,600 --> 00:01:26,660

will build up enough statistics to

31

00:01:32,720 --> 00:01:29,610

analyze for all the things that were

32

00:01:34,340 --> 00:01:32,730

that were interested in I guess that's

33

00:01:37,010 --> 00:01:34,350

the question then what is it are you

34

00:01:39,230 --> 00:01:37,020

interested in then astrophysicists

35

00:01:41,060 --> 00:01:39,240

what's the value of knowing about cosmic

36

00:01:44,120 --> 00:01:41,070

rays okay well cosmic rays are the

37

00:01:46,400 --> 00:01:44,130

highest energy particles known in the

38

00:01:49,340 --> 00:01:46,410

universe nature somehow accelerates

39

00:01:52,720 --> 00:01:49,350

cosmic rays to vast energies far higher

40

00:01:55,130 --> 00:01:52,730

than we can do that at the biggest

41

00:01:59,780 --> 00:01:55,140

accelerator for example the LHC at CERN

42

00:02:03,920 --> 00:01:59,790

and what we're interested in is is a how

43

00:02:06,500 --> 00:02:03,930

they do that and be what material is

44

00:02:09,830 --> 00:02:06,510

being accelerated what where did this

45

00:02:12,200 --> 00:02:09,840

stuff come from and so to do that what

46

00:02:14,630 --> 00:02:12,210

we want to do is we want to measure the

47

00:02:17,150 --> 00:02:14,640

composition we want to know how many

48

00:02:20,920 --> 00:02:17,160

electrons are there how many protons I'm

49

00:02:23,660 --> 00:02:20,930

a helium carbon nitrogen oxygen iron etc

50

00:02:26,900 --> 00:02:23,670

to try to piece together this whole

51  
00:02:31,010 --> 00:02:26,910  
question of how nature does this massive

52  
00:02:34,820 --> 00:02:31,020  
acceleration how it ejects these

53  
00:02:37,010 --> 00:02:34,830  
particles that have been with us in our

54  
00:02:39,290 --> 00:02:37,020  
solar system for billions of years based

55  
00:02:41,620 --> 00:02:39,300  
on the old meteorite measurements oh and

56  
00:02:44,630 --> 00:02:41,630  
they're a standard part of our of our

57  
00:02:47,060 --> 00:02:44,640  
environment you're taking a census of

58  
00:02:48,740 --> 00:02:47,070  
what's out there we're talking to take a

59  
00:02:51,500 --> 00:02:48,750  
census evolve it but we're trying to

60  
00:02:53,330 --> 00:02:51,510  
take it at at higher energies and it's

61  
00:02:55,760 --> 00:02:53,340  
ever been taken before and that's that's

62  
00:02:57,980 --> 00:02:55,770  
the key as you move to the higher and

63  
00:02:59,300 --> 00:02:57,990

higher energy that's where they we're

64

00:03:02,660 --> 00:02:59,310

beginning to see now that's where the

65

00:03:04,460 --> 00:03:02,670

action is starting to show up well one

66

00:03:06,710 --> 00:03:04,470

of the the stated goals here is that

67

00:03:08,540 --> 00:03:06,720

you're using this to address the

68

00:03:11,030 --> 00:03:08,550

existence of dark matter

69

00:03:14,290 --> 00:03:11,040

how does measuring cosmic rays help you

70

00:03:19,790 --> 00:03:14,300

do that well the whole idea here is that

71

00:03:22,720 --> 00:03:19,800

if there are dark matter particles out

72

00:03:25,250 --> 00:03:22,730

there of one sort or another and they

73

00:03:28,760 --> 00:03:25,260

they're their own antiparticle so they

74

00:03:31,700 --> 00:03:28,770

annihilate with with each other when

75

00:03:33,770 --> 00:03:31,710

they do that they turn into normal

76

00:03:36,890 --> 00:03:33,780

particles ie they turn into electron

77

00:03:40,580 --> 00:03:36,900

positron pairs or they turn into proton

78

00:03:43,940 --> 00:03:40,590

any protons or they turn into various

79

00:03:46,430 --> 00:03:43,950

kinds of W bosons things like that but

80

00:03:49,780 --> 00:03:46,440

when they do that they're their mass

81

00:03:53,060 --> 00:03:49,790

energy the rest mass becomes their

82

00:03:56,650 --> 00:03:53,070

kinetic energy so they suddenly appear

83

00:03:59,930 --> 00:03:56,660

at these very very high energies as a

84

00:04:02,060 --> 00:03:59,940

particle zipping around just like the

85

00:04:04,940 --> 00:04:02,070

cosmic rays so the idea is you may be

86

00:04:08,060 --> 00:04:04,950

able to find them within the cosmic ray

87

00:04:10,610 --> 00:04:08,070

beam now to do that we have to look and

88

00:04:12,890 --> 00:04:10,620

see if we can find some kind of anomaly

89

00:04:16,300 --> 00:04:12,900

and the electron plus positron spectrum

90

00:04:19,310 --> 00:04:16,310

or we also have a capability to measure

91

00:04:23,270 --> 00:04:19,320

very high-energy gamma rays see if we

92

00:04:25,430 --> 00:04:23,280

can find a signature in in the gamma ray

93

00:04:27,160 --> 00:04:25,440

region at these ultra high energies I

94

00:04:29,380 --> 00:04:27,170

also read that your

95

00:04:32,290 --> 00:04:29,390

interested in finding what it says are

96

00:04:34,780 --> 00:04:32,300

nearby sources of high-energy cosmic

97

00:04:39,390 --> 00:04:34,790

rays I mean how close are you looking ok

98

00:04:43,710 --> 00:04:39,400

well nearby is is a has to be viewed and

99

00:04:46,690 --> 00:04:43,720

astronomers terms and I will what were

100

00:04:50,230 --> 00:04:46,700

basically looking for is sources that

101  
00:04:54,030 --> 00:04:50,240  
are within about one thousand parsecs of

102  
00:04:56,710 --> 00:04:54,040  
the solar system and are less than about

103  
00:04:58,540 --> 00:04:56,720  
10 to the fifth years old

104  
00:05:00,490 --> 00:04:58,550  
that's one about a hundred thousand

105  
00:05:04,090 --> 00:05:00,500  
years old why is that

106  
00:05:07,270 --> 00:05:04,100  
well the reason is that at the electrons

107  
00:05:11,950 --> 00:05:07,280  
unlike protons and other particles they

108  
00:05:13,870 --> 00:05:11,960  
lose energy via inverse Thompson and

109  
00:05:15,730 --> 00:05:13,880  
synchrotron processes as they move

110  
00:05:18,700 --> 00:05:15,740  
through the galaxy interacting with

111  
00:05:21,780 --> 00:05:18,710  
matter photons and magnetic fields and

112  
00:05:24,640 --> 00:05:21,790  
they lose energy at a phenomenal rate

113  
00:05:27,610 --> 00:05:24,650

what that means is that these very high

114

00:05:30,220 --> 00:05:27,620

energies they can't travel very far

115

00:05:33,100 --> 00:05:30,230

before they're totally degraded thus

116

00:05:37,510 --> 00:05:33,110

anything we see has to be coming from

117

00:05:39,880 --> 00:05:37,520

somewhat relatively nearby otherwise it

118

00:05:42,100 --> 00:05:39,890

would just never get here from there so

119

00:05:44,050 --> 00:05:42,110

in that sense what you do is then you

120

00:05:46,930 --> 00:05:44,060

sit around and say well what's out there

121

00:05:49,060 --> 00:05:46,940

within within a kiloparsec from us and

122

00:05:51,070 --> 00:05:49,070

you find things like supernova remnants

123

00:05:53,920 --> 00:05:51,080

mono gems of turnover reminisce

124

00:05:55,720 --> 00:05:53,930

Cygnus loop the Velo supernova remnant

125

00:05:59,050 --> 00:05:55,730

and you say well could these be

126  
00:06:00,700 --> 00:05:59,060  
producing high-energy electrons and so

127  
00:06:03,580 --> 00:06:00,710  
you go back to some of the theories and

128  
00:06:05,800 --> 00:06:03,590  
do some more calculations and you come

129  
00:06:08,590 --> 00:06:05,810  
out with yes they could be maybe not but

130  
00:06:11,830 --> 00:06:08,600  
they could be so the idea being if we

131  
00:06:14,980 --> 00:06:11,840  
can see one of these sources sticking up

132  
00:06:17,050 --> 00:06:14,990  
beyond above the normal background of

133  
00:06:19,480 --> 00:06:17,060  
all the other electron positrons that

134  
00:06:22,480 --> 00:06:19,490  
are matter that we're seeing we would be

135  
00:06:26,290 --> 00:06:22,490  
able to actually pinpoint a for the

136  
00:06:29,980 --> 00:06:26,300  
first time a source of charged particle

137  
00:06:34,270 --> 00:06:29,990  
acceleration that was in our relatively

138  
00:06:37,470 --> 00:06:34,280

nearby or close solar neighborhood you

139

00:06:39,850 --> 00:06:37,480

might you might say that would give us

140

00:06:40,300 --> 00:06:39,860

something phenomenal to study because

141

00:06:42,580 --> 00:06:40,310

then we

142

00:06:45,310 --> 00:06:42,590

go out looking to see what these

143

00:06:49,480 --> 00:06:45,320

particular objects if we can pin it down

144

00:06:51,570 --> 00:06:49,490

are actually doing in detail and learn a

145

00:06:55,030 --> 00:06:51,580

whole lot about what makes them tick

146

00:06:58,360 --> 00:06:55,040

well dr. Zweifel good luck the interest

147

00:07:00,520 --> 00:06:58,370

to do to see it fly and and see it go to

148

00:07:02,380 --> 00:07:00,530

work and we are equally as well

149

00:07:03,970 --> 00:07:02,390

interested in the successful launch and

150

00:07:06,310 --> 00:07:03,980

starting to get some data after all

151

00:07:08,740 --> 00:07:06,320

these years so thank you very much thank

152

00:07:10,450 --> 00:07:08,750

you dr. John Wavell is professor

153

00:07:13,330 --> 00:07:10,460

emeritus at Louisiana State University