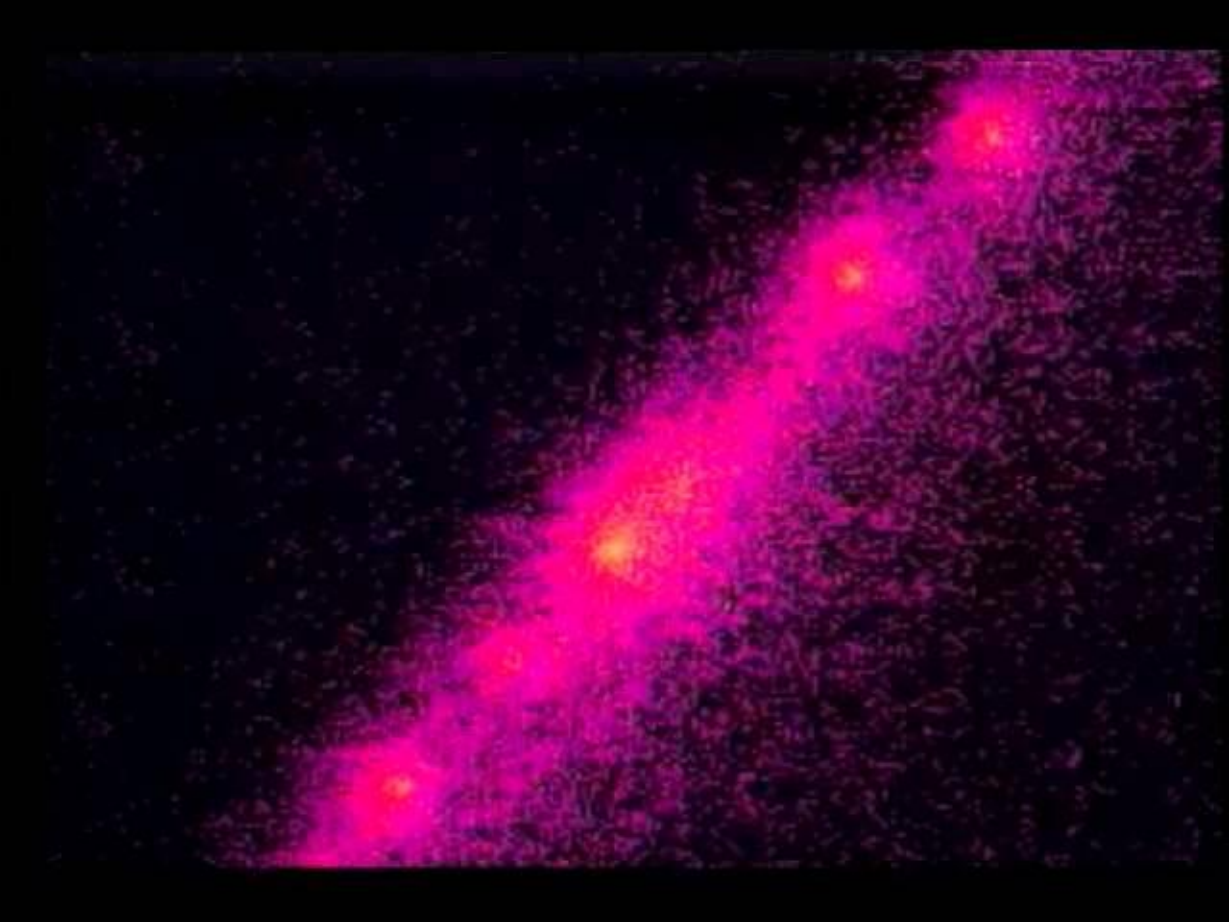

1
00:00:49,400 --> 00:00:47,090
in mid-july major telescopes on earth

2
00:00:51,410 --> 00:00:49,410
and in space will be trained on planet

3
00:00:53,570 --> 00:00:51,420
Jupiter for an encounter that could be

4
00:00:56,570 --> 00:00:53,580
one of the most significant astronomical

5
00:00:58,400 --> 00:00:56,580
events in history a string of over 20

6
00:01:01,070 --> 00:00:58,410
ice and dust fragments from an ancient

7
00:01:04,250 --> 00:01:01,080
comet will plummet into Jupiter causing

8
00:01:06,560 --> 00:01:04,260
massive explosions geologist Eugene

9
00:01:09,170 --> 00:01:06,570
shoemaker astronomer Carolyn shoemaker

10
00:01:12,920 --> 00:01:09,180
and amateur astronomer David Levy found

11
00:01:15,469 --> 00:01:12,930
the comet in March 1993 during a survey

12
00:01:18,560 --> 00:01:15,479
of the sky at Mount Palomar Observatory

13
00:01:20,719 --> 00:01:18,570

no one is quite sure what effect the

14
00:01:23,780 --> 00:01:20,729
comet's impact will have on the planet

15
00:01:26,690 --> 00:01:23,790
an immense globe of gas a thousand times

16
00:01:29,870 --> 00:01:26,700
larger than the earth well the $64

17
00:01:32,900 --> 00:01:29,880
question is how big are the fragments at

18
00:01:35,120 --> 00:01:32,910
one point some months ago we thought the

19
00:01:38,090 --> 00:01:35,130
largest might be about three maybe even

20
00:01:41,450 --> 00:01:38,100
four kilometers across if they were that

21
00:01:45,680 --> 00:01:41,460
large then altogether these comets would

22
00:01:49,999 --> 00:01:45,690
deliver about a hundred million megatons

23
00:01:52,219 --> 00:01:50,009
of energy computer simulations of the

24
00:01:54,410 --> 00:01:52,229
impacts effect on Jupiter have been made

25
00:01:57,260 --> 00:01:54,420
by astronomers at the Massachusetts

26
00:01:59,809 --> 00:01:57,270
Institute of Technology during the six

27
00:02:02,540 --> 00:01:59,819
days of bombardment major observatories

28
00:02:04,609 --> 00:02:02,550
of the world hope to study the event the

29
00:02:06,910 --> 00:02:04,619
impact sites will occur on the opposite

30
00:02:10,309 --> 00:02:06,920
side of Jupiter away from Earth's view

31
00:02:12,080 --> 00:02:10,319
the Galileo spacecraft now enroute to

32
00:02:15,170 --> 00:02:12,090
Jupiter will view the event head-on

33
00:02:17,180 --> 00:02:15,180
eventually sending back images whether

34
00:02:20,090 --> 00:02:17,190
the event goes off with a bang or a

35
00:02:47,360 --> 00:02:20,100
whimper few astronomers will miss this

36
00:02:53,449 --> 00:02:51,050
in mid-july major telescopes on earth

37
00:02:55,460 --> 00:02:53,459
and in space will be trained on planet

38
00:02:57,619 --> 00:02:55,470

Jupiter for an encounter that could be

39
00:03:01,009 --> 00:02:57,629
one of the most significant astronomical

40
00:03:03,080 --> 00:03:01,019
events in history a string of over 20

41
00:03:06,199 --> 00:03:03,090
ice and dust fragments from an ancient

42
00:03:08,509 --> 00:03:06,209
comet will plummet into Jupiter causing

43
00:03:11,030 --> 00:03:08,519
massive explosions it's the first time

44
00:03:13,190 --> 00:03:11,040
ever that we've seen a comma captured in

45
00:03:14,869 --> 00:03:13,200
orbit around Jupiter and it's the first

46
00:03:27,250 --> 00:03:14,879
time ever we'll actually be able to

47
00:03:32,420 --> 00:03:30,290
geologist Eugene shoemaker astronomer

48
00:03:35,540 --> 00:03:32,430
Carolyn shoemaker an amateur astronomer

49
00:03:44,900 --> 00:03:35,550
David Levy found the comet at the end of

50
00:03:47,330 --> 00:03:44,910
March 1993 so lovely day from their

51
00:03:50,630 --> 00:03:47,340
perch atop Mount Palomar in Southern

52
00:03:55,199 --> 00:03:50,640
California big monitors night sky using

53
00:03:57,209 --> 00:03:55,209
a 60 year old eighteen inch telescope

54
00:03:59,099 --> 00:03:57,219
the vintage instrument has perfect

55
00:04:05,690 --> 00:03:59,109
properties for spotting fast-moving

56
00:04:08,369 --> 00:04:05,700
objects it is actually a camera

57
00:04:11,160 --> 00:04:08,379
exposures of eight minutes are used for

58
00:04:13,259 --> 00:04:11,170
each picture the field of view takes in

59
00:04:19,020 --> 00:04:13,269
the mind of the normal portion of the

60
00:04:25,680 --> 00:04:19,030
sky making it an ideal response okay

61
00:04:27,659 --> 00:04:25,690
does that look right yes discovery high

62
00:04:31,080 --> 00:04:27,669
clouds threatened to cancel their

63
00:04:33,450 --> 00:04:31,090

efforts prospects didn't look good but

64
00:04:35,999 --> 00:04:33,460
David Levy suggested that they continue

65
00:04:40,140 --> 00:04:36,009
using damaged film that would have been

66
00:04:42,089 --> 00:04:40,150
thrown away that decision paid off we

67
00:04:44,339 --> 00:04:42,099
knew we had something very unusual it

68
00:04:46,770 --> 00:04:44,349
was so unusual we were a little unsure

69
00:04:49,999 --> 00:04:46,780
just what we were dealing with so I

70
00:04:53,820 --> 00:04:50,009
started to scan it and Jupiter was a big

71
00:04:56,670 --> 00:04:53,830
overexposed looking blob on one side I

72
00:05:00,120 --> 00:04:56,680
started at the top and across and down

73
00:05:03,300 --> 00:05:00,130
and then as I moved across about a

74
00:05:06,779 --> 00:05:03,310
little more than halfway down I suddenly

75
00:05:08,879 --> 00:05:06,789
thought I saw something Carolyn used a

76
00:05:11,370 --> 00:05:08,889
stereo microscope to look at two

77
00:05:14,399 --> 00:05:11,380
pictures taken 40 minutes apart of the

78
00:05:16,920 --> 00:05:14,409
exact same location as he viewed the

79
00:05:19,469 --> 00:05:16,930
images simultaneously everything looked

80
00:05:22,589 --> 00:05:19,479
flat except fast-moving objects like

81
00:05:25,710 --> 00:05:22,599
asteroids or comets they appeared to

82
00:05:28,560 --> 00:05:25,720
float I turned to the others and I I

83
00:05:31,800 --> 00:05:28,570
said I don't know what I've got it looks

84
00:05:34,170 --> 00:05:31,810
like a squashed comet the squashed comet

85
00:05:36,719 --> 00:05:34,180
turned out to be a chain of fragments

86
00:05:39,029 --> 00:05:36,729
they were formed when Jupiter's immense

87
00:05:42,600 --> 00:05:39,039
gravitational force pulled the comet

88
00:05:45,149 --> 00:05:42,610

apart as it passed by the giant planet

89
00:05:47,700 --> 00:05:45,159
Nance's newly repaired Hubble Space

90
00:05:50,189 --> 00:05:47,710
Telescope took these images of the comet

91
00:05:52,200 --> 00:05:50,199
it's powerful mirrors bringing each

92
00:05:54,990 --> 00:05:52,210
fragment into sharp focus

93
00:05:58,159 --> 00:05:55,000
well the $64 question is how big are the

94
00:06:00,809 --> 00:05:58,169
fragments at one point some months ago

95
00:06:02,520 --> 00:06:00,819
we thought the largest fragments might

96
00:06:06,270 --> 00:06:02,530
be about three maybe even four

97
00:06:08,850 --> 00:06:06,280
kilometers across about two and a up to

98
00:06:12,540 --> 00:06:08,860
two and a half miles in diameter if they

99
00:06:15,360 --> 00:06:12,550
were that large then altogether these

100
00:06:19,619 --> 00:06:15,370
comets would deliver about a hundred

101
00:06:21,749 --> 00:06:19,629
million megatons of energy but no one is

102
00:06:24,420 --> 00:06:21,759
quite sure what effect the impacts will

103
00:06:27,029 --> 00:06:24,430
have on the planet an immense globe of

104
00:06:27,709 --> 00:06:27,039
gas a thousand times larger than the

105
00:06:30,450 --> 00:06:27,719
earth

106
00:06:32,070 --> 00:06:30,460
Timothy Dowling and Joe Harrington of

107
00:06:34,350 --> 00:06:32,080
the Massachusetts Institute of

108
00:06:36,269 --> 00:06:34,360
Technology have developed a computer

109
00:06:38,929 --> 00:06:36,279
model that shows the effect of the

110
00:06:41,670 --> 00:06:38,939
Comets impact on Jupiter's atmosphere

111
00:06:43,469 --> 00:06:41,680
the comet pieces will plunge down

112
00:06:45,300 --> 00:06:43,479
underneath the clouds these beautiful

113
00:06:47,640 --> 00:06:45,310

ammonia clouds that are on the surface

114
00:06:50,070 --> 00:06:47,650
and finally just give up and explode and

115
00:06:51,930 --> 00:06:50,080
all of that hot heated gas will rise up

116
00:06:53,399 --> 00:06:51,940
and then it'll fall back down and you'll

117
00:06:55,230 --> 00:06:53,409
get just like throwing a rock into a

118
00:06:57,839 --> 00:06:55,240
pond you won't get this big splash and

119
00:07:00,869 --> 00:06:57,849
then the slower ripple during the six

120
00:07:03,839 --> 00:07:00,879
days of bombardment major observatories

121
00:07:06,089 --> 00:07:03,849
of the world hope to study the event the

122
00:07:09,110 --> 00:07:06,099
impact sites will occur on the opposite

123
00:07:11,730 --> 00:07:09,120
side of Jupiter away from Earth's view

124
00:07:13,920 --> 00:07:11,740
scientists hope to see after effects of

125
00:07:16,969 --> 00:07:13,930
the impacts or flashes of light

126
00:07:20,730 --> 00:07:16,979
reflected on to Jupiter's nearby moons

127
00:07:22,850 --> 00:07:20,740
the Galileo spacecraft now and route to

128
00:07:26,219 --> 00:07:22,860
Jupiter will view the event head-on

129
00:07:28,740 --> 00:07:26,229
eventually sending back images it will

130
00:07:31,060 --> 00:07:28,750
be an unprecedented opportunity to learn

131
00:07:33,580 --> 00:07:31,070
about the planets weather patterns

132
00:07:36,190 --> 00:07:33,590
Joe Harrington believes the explosions

133
00:07:38,590 --> 00:07:36,200
could trigger storm systems in normally

134
00:07:40,900 --> 00:07:38,600
stable areas if the pieces are big

135
00:07:42,250 --> 00:07:40,910
enough to produce any kind of observable

136
00:07:43,420 --> 00:07:42,260
effect at all anything that makes the

137
00:07:44,170 --> 00:07:43,430
planet look different from the way it

138
00:07:45,760 --> 00:07:44,180

looks today

139
00:07:47,920 --> 00:07:45,770
will learn something and the more

140
00:07:50,350 --> 00:07:47,930
changes the more we'll learn in fact

141
00:07:52,420 --> 00:07:50,360
there are valuable lessons in store for

142
00:07:54,610 --> 00:07:52,430
our own planet there are a lot of people

143
00:07:57,400 --> 00:07:54,620
that believe that an impact about the

144
00:07:59,800 --> 00:07:57,410
size of the combined comet train is what

145
00:08:02,560 --> 00:07:59,810
killed off the dinosaurs gene shoemaker

146
00:08:05,620 --> 00:08:02,570
has long supported the theory that comet

147
00:08:07,840 --> 00:08:05,630
material landed some 4.5 billion years

148
00:08:10,300 --> 00:08:07,850
ago and delivered life's essential

149
00:08:13,530 --> 00:08:10,310
ingredients to earth in essence I think

150
00:08:15,790 --> 00:08:13,540
we're the progeny of comet's comets

151
00:08:19,120 --> 00:08:15,800
arriving early in the history of the

152
00:08:22,900 --> 00:08:19,130
solar system delivered the volatile

153
00:08:25,030 --> 00:08:22,910
material come july 16 damager and

154
00:08:27,310 --> 00:08:25,040
professional astronomers alike will

155
00:08:29,590 --> 00:08:27,320
train their telescopes on jupiter

156
00:08:33,370 --> 00:08:29,600
whether the event goes off with a bang

157
00:13:17,519 --> 00:08:33,380
or a whimper few astronomers will miss

158
00:13:22,500 --> 00:13:20,220
we knew he had something very unusual it

159
00:13:24,389 --> 00:13:22,510
was so unusual we were a little unsure

160
00:13:27,030 --> 00:13:24,399
just what we were dealing with

161
00:13:29,490 --> 00:13:27,040
we were pretty stacked up and when I

162
00:13:33,900 --> 00:13:29,500
looked at it I realized that what I saw

163
00:13:38,879 --> 00:13:33,910

was a bar and this bar had coma and

164
00:13:41,790 --> 00:13:38,889
Tails and I that was um it's unspeakably

165
00:13:43,829 --> 00:13:41,800
weird you just don't find something like

166
00:13:47,460 --> 00:13:43,839
that when you're looking for either

167
00:13:49,980 --> 00:13:47,470
asteroids or comets and nothing no yes

168
00:13:51,720 --> 00:13:49,990
but comet pieces will plunge down

169
00:13:53,400 --> 00:13:51,730
underneath the clouds these beautiful

170
00:13:55,829 --> 00:13:53,410
ammonia clouds that are on the surface

171
00:13:58,079 --> 00:13:55,839
plunge down underneath and finally just

172
00:14:00,210 --> 00:13:58,089
give up and explode and all of that hot

173
00:14:02,009 --> 00:14:00,220
heated gas will rise up and then it'll

174
00:14:03,210 --> 00:14:02,019
fall back down and you'll get just like

175
00:14:05,280 --> 00:14:03,220
throwing a rock into a pond you won't