1
00:00:27,520 --> 00:00:21,140
there's something mysterious about the

2
00:00:32,170 --> 00:00:27,530
universe intriguing fascinating

3
00:00:34,830 --> 00:00:32,180
what's really out there how did it all

4
00:00:38,610 --> 00:00:34,840
come about

5
00:00:41,970 --> 00:00:38,620
are the stars just like our son perhaps

6
00:00:47,270 --> 00:00:41,980
some with planets and some of those with

7
00:00:51,479 --> 00:00:47,280
life and maybe some of that life like us

8
00:00:52,700 --> 00:00:51,489
we look at stars and theorize what's

9
00:00:56,760 --> 00:00:52,710
going on

10
00:00:59,720 --> 00:00:56,770
we've only a handful of facts each one

11
00:01:04,350 --> 00:00:59,730
paid for with years of observing

12
00:01:08,100 --> 00:01:04,360
starlight but stars send us a lot more

13
00:01:11,160 --> 00:01:08,110

than just light stars are sources of

14
00:01:13,560 --> 00:01:11,170
incredible amounts of energy and this

15
00:01:17,190 --> 00:01:13,570
energy is broadcast throughout the

16
00:01:21,180 --> 00:01:17,200
universe as light radio waves X and M

17
00:01:24,330 --> 00:01:21,190
arrays and cosmic particles and these

18
00:01:28,020 --> 00:01:24,340
energies tell us about startling objects

19
00:01:31,410 --> 00:01:28,030
in the universe quasars that look like

20
00:01:36,870 --> 00:01:31,420
large stars but produce more energy than

21
00:01:39,059 --> 00:01:36,880
ten thousand billion stars pulsars the

22
00:01:42,029 --> 00:01:39,069
collapsed remnants of supernova

23
00:01:45,840 --> 00:01:42,039
explosions that sweep beams of energy

24
00:01:50,399 --> 00:01:45,850
across space like a lighthouse beacon

25
00:01:52,680 --> 00:01:50,409
black holes huge massive scars that have

26
00:01:56,580 --> 00:01:52,690
collapsed to something perhaps five

27
00:01:58,770 --> 00:01:56,590
miles across and so dense that even

28
00:02:03,250 --> 00:01:58,780
light can't escape they're tremendously

29
00:02:08,610 --> 00:02:05,890
the recent discoveries of these bizarre

30
00:02:10,930 --> 00:02:08,620
and exciting objects have led to

31
00:02:14,190 --> 00:02:10,940
revolutionary new theories about energy

32
00:02:17,580 --> 00:02:14,200
matter and the origin of the universe

33
00:02:20,020 --> 00:02:17,590
these discoveries may shake the very

34
00:02:22,660 --> 00:02:20,030
foundations of science carrying

35
00:02:26,930 --> 00:02:22,670
scientists beyond atomic and nuclear

36
00:02:34,610 --> 00:02:30,350
why all this excitement it's as if we've

37
00:02:37,430 --> 00:02:34,620
discovered a new universe in fact in the

38
00:02:39,740 --> 00:02:37,440

past few years we've learned more about

39
00:02:43,820 --> 00:02:39,750
some of the things going on out there

40
00:03:12,420 --> 00:02:43,830
than in 3000 years spent gazing at

41
00:03:19,319 --> 00:03:15,869
up until this century all astronomy was

42
00:03:21,920 --> 00:03:19,329
done by human eyes and telescopes but

43
00:03:24,030 --> 00:03:21,930
the human eye can't see high-energy and

44
00:03:26,970 --> 00:03:24,040
even if the human eye could see

45
00:03:29,099 --> 00:03:26,980
high-energy the high-energy universe is

46
00:03:32,970 --> 00:03:29,109
hidden from us by the Earth's blank

47
00:03:36,599 --> 00:03:32,980
atmosphere light and radio waves pass

48
00:03:39,000 --> 00:03:36,609
through the atmosphere fairly easily but

49
00:03:41,610 --> 00:03:39,010
the electromagnetic spectrum covers an

50
00:03:45,089 --> 00:03:41,620
extremely broad range of energy waves

51
00:03:46,979 --> 00:03:45,099
including x-rays and gamma rays which

52
00:03:50,699 --> 00:03:46,989
are absorbed by water and other

53
00:03:53,759 --> 00:03:50,709
molecules in our atmosphere we have to

54
00:03:55,409 --> 00:03:53,769
get above the atmosphere and use special

55
00:03:59,369 --> 00:03:55,419
instruments to conduct high-energy

56
00:04:01,229 --> 00:03:59,379
astronomy investigations and this is

57
00:04:03,839 --> 00:04:01,239
exactly what we're doing

58
00:04:06,390 --> 00:04:03,849
NASA is cooperating with leading

59
00:04:08,520 --> 00:04:06,400
scientific institutions and industrial

60
00:04:11,640 --> 00:04:08,530
firms across the nation and Western

61
00:04:15,170 --> 00:04:11,650
Europe in constructing a series of three

62
00:04:19,979 --> 00:04:15,180
high-energy astronomy observatories heõs

63
00:04:26,629 --> 00:04:19,989

they will be launched in 1977 78 and 79

64
00:04:31,779 --> 00:04:28,969
most of the stars that we've seen our

65
00:04:35,689 --> 00:04:31,789
universe burned by burning nuclear fuel

66
00:04:38,540 --> 00:04:35,699
there are ever stars and galaxies in

67
00:04:41,379 --> 00:04:38,550
which energy is released in much greater

68
00:04:44,240 --> 00:04:41,389
amounts that occurs in our own Sun and

69
00:04:47,270 --> 00:04:44,250
the energy release occurs very suddenly

70
00:04:50,689 --> 00:04:47,280
we call these events explosions

71
00:04:53,240 --> 00:04:50,699
occurring in stars and galaxies what

72
00:04:55,339 --> 00:04:53,250
causes these explosions what physical

73
00:04:57,830 --> 00:04:55,349
processes go on that produced them and

74
00:05:00,860 --> 00:04:57,840
what is the role of explosions over

75
00:05:03,230 --> 00:05:00,870
explosive events in the creation and

76
00:05:05,149 --> 00:05:03,240
evolution of the universe is the proper

77
00:05:07,730 --> 00:05:05,159
field of study for high energy

78
00:05:10,670 --> 00:05:07,740
astrophysics great breakthroughs and

79
00:05:12,439 --> 00:05:10,680
physics come once in a generation the

80
00:05:16,219 --> 00:05:12,449
practical benefits often come a

81
00:05:18,920 --> 00:05:16,229
generation later 50 years ago we were

82
00:05:21,409 --> 00:05:18,930
concerned about atomic physics now we

83
00:05:24,379 --> 00:05:21,419
have nuclear energy and many other

84
00:05:29,680 --> 00:05:24,389
benefits to mankind solid-state physics

85
00:05:36,370 --> 00:05:31,930
we don't know where high-energy

86
00:05:39,880 --> 00:05:36,380
astronomy is going to take us it will

87
00:05:41,770 --> 00:05:39,890
enable us to test general relativity in

88
00:05:44,830 --> 00:05:41,780

ways which have never been available to

89
00:05:47,740 --> 00:05:44,840
us before it will give us an entirely

90
00:05:53,130 --> 00:05:47,750
new look at the universe we can't afford

91
00:05:58,950 --> 00:05:56,310
x-ray astronomy really began in 1962

92
00:06:04,620 --> 00:05:58,960
with rocket launches and the discovery

93
00:06:12,840 --> 00:06:08,430
by 1969 we had detected sources to the

94
00:06:15,390 --> 00:06:12,850
far ends of the universe rockets have a

95
00:06:17,760 --> 00:06:15,400
very short time above the atmosphere and

96
00:06:20,940 --> 00:06:17,770
we need to be in that position to make

97
00:06:23,520 --> 00:06:20,950
x-ray observations pinpointing of the

98
00:06:25,530 --> 00:06:23,530
sources and the exact location was

99
00:06:30,300 --> 00:06:25,540
difficult to ascertain in such a short

100
00:06:32,970 --> 00:06:30,310
time therefore NASA decided in 1970 to

101
00:06:34,950 --> 00:06:32,980
launch a small astronomy satellite to

102
00:06:37,230 --> 00:06:34,960
take a more penetrating look at all the

103
00:06:39,570 --> 00:06:37,240
x-ray sources that could be discovered

104
00:06:44,340 --> 00:06:39,580
with such a primitive instrument as well

105
00:06:47,010 --> 00:06:44,350
as available to us at that time out of

106
00:06:49,140 --> 00:06:47,020
the small satellite observations doctor

107
00:06:53,250 --> 00:06:49,150
giacconi and his group of scientists

108
00:06:56,010 --> 00:06:53,260
developed this map it consists now of

109
00:07:01,890 --> 00:06:56,020
about 160 sources most of which are

110
00:07:03,990 --> 00:07:01,900
located in our own galaxy the study of

111
00:07:06,390 --> 00:07:04,000
stellar evolution tells us that the

112
00:07:08,760 --> 00:07:06,400
Stars spend most of their life quietly

113
00:07:10,950 --> 00:07:08,770

burning away their nuclear fuels as if

114
00:07:13,800 --> 00:07:10,960
they were giant reactors in which the

115
00:07:15,540 --> 00:07:13,810
hydrogen trust mutes into helium when

116
00:07:19,050 --> 00:07:15,550
and the helium and carbon and so forth

117
00:07:22,110 --> 00:07:19,060
once all of their nuclear fuels are

118
00:07:23,970 --> 00:07:22,120
burned very dramatic changes occur

119
00:07:27,600 --> 00:07:23,980
particularly stars which are more

120
00:07:30,660 --> 00:07:27,610
massive than our own Sun what happens is

121
00:07:32,310 --> 00:07:30,670
that the force of gravity acting on the

122
00:07:34,960 --> 00:07:32,320
outer layer of the stars can no longer

123
00:07:37,450 --> 00:07:34,970
be balanced by the pressure of the

124
00:07:42,310 --> 00:07:37,460
heat inside and therefore the outer

125
00:07:44,740 --> 00:07:42,320
layers collapse lag behind and then are

126
00:07:51,090 --> 00:07:44,750
explosively ejected and we have what we

127
00:07:55,210 --> 00:07:51,100
call a supernova explosion on July 4th

128
00:07:57,490 --> 00:07:55,220
1054 ad a spectacular supernova was

129
00:08:01,300 --> 00:07:57,500
recorded by American Indians and Chinese

130
00:08:05,050 --> 00:08:01,310
astronomers this supernova produced the

131
00:08:08,470 --> 00:08:05,060
Crab Nebula but it wasn't until 1968

132
00:08:11,530 --> 00:08:08,480
that radio telescopes found a very small

133
00:08:15,670 --> 00:08:11,540
blue star pulsing in the center of the

134
00:08:18,610 --> 00:08:15,680
Crab Nebula at first the regularity of

135
00:08:20,860 --> 00:08:18,620
the pulsations they were observing led

136
00:08:22,870 --> 00:08:20,870
them to think that this might be signals

137
00:08:25,630 --> 00:08:22,880
from a an intelligent civilization

138
00:08:28,600 --> 00:08:25,640

trying to communicate with us it was

139
00:08:31,630 --> 00:08:28,610
later decided that these were natural

140
00:08:34,750 --> 00:08:31,640
signals produced by collapsed star a

141
00:08:38,290 --> 00:08:34,760
pulsar found at the center the remnant

142
00:08:41,050 --> 00:08:38,300
of the supernova explosion what we think

143
00:08:43,810 --> 00:08:41,060
happens in a supernova explosion is that

144
00:08:45,460 --> 00:08:43,820
as the nuclear fuel is burned the outer

145
00:08:48,220 --> 00:08:45,470
layer of the star start collapsing

146
00:08:50,660 --> 00:08:48,230
toward the center if the star is very

147
00:08:53,390 --> 00:08:50,670
massive there is no force that we know

148
00:08:55,910 --> 00:08:53,400
that can prevent it from being crushed

149
00:08:59,960 --> 00:08:55,920
to about ten kilometer size retaining

150
00:09:01,790 --> 00:08:59,970
the same mass this is like crushing the

151
00:09:05,930 --> 00:09:01,800
earth into the size of a football field

152
00:09:07,880 --> 00:09:05,940
as it gets smaller it spins faster and

153
00:09:09,650 --> 00:09:07,890
since the amount of matter is

154
00:09:12,260 --> 00:09:09,660
essentially the same as when it was a

155
00:09:15,050 --> 00:09:12,270
larger star it's magnetic and

156
00:09:18,050 --> 00:09:15,060
gravitational fields are still as great

157
00:09:22,730 --> 00:09:18,060
in fact they are tremendous compared to

158
00:09:25,430 --> 00:09:22,740
it's now very compact size in a neutron

159
00:09:27,410 --> 00:09:25,440
star the collapse stops when the atoms

160
00:09:29,750 --> 00:09:27,420
have been crushed together to such an

161
00:09:33,260 --> 00:09:29,760
extent that instead of having separate

162
00:09:37,760 --> 00:09:33,270
protons and electrons we have a neutron

163
00:09:40,190 --> 00:09:37,770

souq now if a neutron star is an orbit

164
00:09:41,630 --> 00:09:40,200
around a normal star like the pair of

165
00:09:44,450 --> 00:09:41,640
stars in Hercules

166
00:09:46,910 --> 00:09:44,460
then as the normal companion loses mass

167
00:09:49,390 --> 00:09:46,920
the gravity from the compressed star

168
00:09:52,220 --> 00:09:49,400
captures the matter from its neighbor as

169
00:09:55,490 --> 00:09:52,230
the matter falls into the magnetic poles

170
00:09:57,830 --> 00:09:55,500
of the neutron star it heats up to very

171
00:10:00,950 --> 00:09:57,840
high temperatures and shoots out a

172
00:10:03,710 --> 00:10:00,960
stream of energy X and gamma rays that

173
00:10:06,950 --> 00:10:03,720
our satellite observatories will be able

174
00:10:10,100 --> 00:10:06,960
to record but why does it appear to be

175
00:10:13,160 --> 00:10:10,110
pulsating when the magnetic poles are

176
00:10:15,980 --> 00:10:13,170
not the axis of rotation every time the

177
00:10:18,620 --> 00:10:15,990
star rotates the stream of energy is

178
00:10:22,580 --> 00:10:18,630
swept through space and appears to us as

179
00:10:27,080 --> 00:10:24,650
but in nature theories of gravitation

180
00:10:29,840 --> 00:10:27,090
tell us they can be even more exciting

181
00:10:32,120 --> 00:10:29,850
objects obviously which are so massive

182
00:10:35,530 --> 00:10:32,130
that the collapse does not stop at that

183
00:10:38,750 --> 00:10:35,540
point and continues this is a black hole

184
00:10:41,240 --> 00:10:38,760
our black holes are may exist in nature

185
00:10:44,060 --> 00:10:41,250
in very large numbers there may be very

186
00:10:45,530 --> 00:10:44,070
large masses small masses for instance

187
00:10:48,160 --> 00:10:45,540
there could be a very large black hole

188
00:10:50,870 --> 00:10:48,170

at the center of our own galaxy which

189
00:10:55,769 --> 00:10:50,880
accretes gas and dust as if it were a

190
00:11:01,920 --> 00:10:58,980
Oppenheimer predicted as early as 1930

191
00:11:05,249 --> 00:11:01,930
that the endpoint of stellar evolution

192
00:11:08,449 --> 00:11:05,259
had to be a black hole if the original

193
00:11:10,470 --> 00:11:08,459
star is massive enough when it collapses

194
00:11:13,019 --> 00:11:10,480
everything is crushed under the

195
00:11:15,030 --> 00:11:13,029
tremendous gravitational force - some

196
00:11:19,290 --> 00:11:15,040
sort of basic super dense form

197
00:11:22,439 --> 00:11:19,300
resembling primeval matter its gravity

198
00:11:24,090 --> 00:11:22,449
becomes so strong even light could not

199
00:11:27,420 --> 00:11:24,100
escape the neighbourhood of this black

200
00:11:30,960 --> 00:11:27,430
hole and if no light or other energy

201
00:11:34,019 --> 00:11:30,970
escapes it we can't see it we call it a

202
00:11:37,460 --> 00:11:34,029
black hole in space matter and energy

203
00:11:41,249 --> 00:11:37,470
are sucked in but nothing ever comes out

204
00:11:42,989 --> 00:11:41,259
in 1972 as we were scanning the sky in

205
00:11:45,389 --> 00:11:42,999
search of x-ray sources with the

206
00:11:48,210 --> 00:11:45,399
instruments of all the Uhuru satellite

207
00:11:52,139 --> 00:11:48,220
we noticed a very rapidly flickering

208
00:11:54,720 --> 00:11:52,149
storm and by studying its x-ray emitting

209
00:11:57,119 --> 00:11:54,730
characteristic we concluded that we had

210
00:12:00,449 --> 00:11:57,129
the best candidate for a possible black

211
00:12:02,309 --> 00:12:00,459
hole that stars becomes a very

212
00:12:06,620 --> 00:12:02,319
intensively studied and it's very well

213
00:12:11,400 --> 00:12:09,390

one of the fascinating questions in

214
00:12:12,930 --> 00:12:11,410
astrophysics is how the tremendous

215
00:12:15,780 --> 00:12:12,940
amount of energy we should release from

216
00:12:17,970 --> 00:12:15,790
Cygnus x1 is actually produced here on

217
00:12:19,740 --> 00:12:17,980
earth if I took this tone and dropped it

218
00:12:21,269 --> 00:12:19,750
they stone would acquire certain amount

219
00:12:22,350 --> 00:12:21,279
of kinetic energy and as he drops

220
00:12:24,600 --> 00:12:22,360
through the ground will make a little

221
00:12:26,700 --> 00:12:24,610
dent but that energy of course is very

222
00:12:28,560 --> 00:12:26,710
small I took the same stone and I'd

223
00:12:31,050 --> 00:12:28,570
burned it in a nuclear reactor then I

224
00:12:33,450 --> 00:12:31,060
could get much more energy if I drop

225
00:12:35,340 --> 00:12:33,460
this stone in a black hole the amount of

226
00:12:37,320 --> 00:12:35,350
energy which is afar there's many many

227
00:12:40,980 --> 00:12:37,330
times what I could acquire by burning

228
00:12:44,400 --> 00:12:40,990
there says nuclear fuel and that is the

229
00:12:48,000 --> 00:12:44,410
origin of the energy release in Cygnus

230
00:12:50,579 --> 00:12:48,010
x1 but we think we have discovered

231
00:12:53,579 --> 00:12:50,589
something outside our own Milky Way

232
00:13:00,050 --> 00:12:53,589
galaxy even more energetic than the

233
00:13:07,670 --> 00:13:03,620
quasars are the most violently energetic

234
00:13:10,760 --> 00:13:07,680
objects in our amazing universe if we

235
00:13:12,980 --> 00:13:10,770
believe the redshifts they tell us that

236
00:13:14,800 --> 00:13:12,990
the most distant quasars are near the

237
00:13:17,360 --> 00:13:14,810
edge of the universe

238
00:13:19,340 --> 00:13:17,370

measuring redshifts is a method that

239
00:13:21,680 --> 00:13:19,350
astronomers use for determining the

240
00:13:25,610 --> 00:13:21,690
speed which a distant object such as a

241
00:13:28,820 --> 00:13:25,620
star or quasar is traveling light is

242
00:13:32,060 --> 00:13:28,830
energy waves and in the visible range

243
00:13:35,450 --> 00:13:32,070
shorter waves are blue and longer ones

244
00:13:36,080 --> 00:13:35,460
red now if a source of light were moving

245
00:13:38,900 --> 00:13:36,090
toward us

246
00:13:41,830 --> 00:13:38,910
then the light waves would crowd up get

247
00:13:44,840 --> 00:13:41,840
shorter and the source would look blue

248
00:13:48,020 --> 00:13:44,850
when we look at a quasar we see it

249
00:13:51,560 --> 00:13:48,030
moving away the waves are stretched and

250
00:13:54,700 --> 00:13:51,570
it appears to shift to the red this

251
00:13:57,080 --> 00:13:54,710
phenomena is called the Doppler shift

252
00:14:01,100 --> 00:13:57,090
quasars have been detected with red

253
00:14:11,790 --> 00:14:01,110
shifts that correspond to 90% of the

254
00:14:17,519 --> 00:14:15,210
was observed to flare to more than

255
00:14:21,870 --> 00:14:17,529
10,000 times the brightness of the Milky

256
00:14:24,509 --> 00:14:21,880
Way in about 13 days that means that

257
00:14:27,090 --> 00:14:24,519
it's size is something like 13 light

258
00:14:30,139 --> 00:14:27,100
days compared to a thousand hundred

259
00:14:33,449 --> 00:14:30,149
thousand light years for the Milky Way

260
00:14:37,230 --> 00:14:33,459
nuclear energy is no explanation for

261
00:14:39,930 --> 00:14:37,240
that kind of phenomenon we believe some

262
00:14:43,290 --> 00:14:39,940
form of gravitational collapse

263
00:14:45,240 --> 00:14:43,300

perhaps a super massive black hole a

264
00:14:48,990 --> 00:14:45,250
hundred million Suns collapsed to a

265
00:14:52,680 --> 00:14:49,000
black hole may be involved we don't know

266
00:14:55,040 --> 00:14:52,690
whether quasars are some link in the

267
00:14:59,430 --> 00:14:55,050
normal evolution of galaxies or

268
00:15:02,220 --> 00:14:59,440
something totally apart as a result of

269
00:15:04,079 --> 00:15:02,230
these astounding finding the National

270
00:15:07,170 --> 00:15:04,089
Academy of Sciences put more emphasis

271
00:15:10,470 --> 00:15:07,180
and high priority on additional studies

272
00:15:12,980 --> 00:15:10,480
and observations NASA decided to

273
00:15:15,449 --> 00:15:12,990
initiate a new program of larger more

274
00:15:18,600 --> 00:15:15,459
sophisticated satellites the heal

275
00:15:21,000 --> 00:15:18,610
program equipment for the three hero

276
00:15:23,430 --> 00:15:21,010
missions is now being assembled across

277
00:15:25,800 --> 00:15:23,440
the country by men and women in

278
00:15:27,240 --> 00:15:25,810
scientific educational and government

279
00:15:30,000 --> 00:15:27,250
installations

280
00:15:33,450 --> 00:15:30,010
this equipment consists of large and

281
00:16:26,020 --> 00:15:33,460
sensitive x-ray gamma ray and cosmic ray

282
00:16:30,040 --> 00:16:28,570
what we plan to do with the heõs is

283
00:16:34,360 --> 00:16:30,050
launched three different observatories

284
00:16:36,850 --> 00:16:34,370
in 1977 1978 and 1979

285
00:16:38,800 --> 00:16:36,860
they'll be launched by rockets from the

286
00:16:41,830 --> 00:16:38,810
Kennedy Space Center in Florida

287
00:16:43,750 --> 00:16:41,840
each Observatory will weigh 7,000 pounds

288
00:16:45,460 --> 00:16:43,760

and there'll be two major sections of

289
00:16:47,950 --> 00:16:45,470
each Observatory they'll be the

290
00:16:49,660 --> 00:16:47,960
experiment module and a spacecraft

291
00:16:54,610 --> 00:16:49,670
module when they're flying they'll

292
00:16:57,250 --> 00:16:54,620
actually be joined together the

293
00:16:59,530 --> 00:16:57,260
spacecraft module will provide all the

294
00:17:01,900 --> 00:16:59,540
necessary housekeeping functions for the

295
00:17:03,730 --> 00:17:01,910
experiments keeping them at the right

296
00:17:06,520 --> 00:17:03,740
temperature providing them with

297
00:17:08,290 --> 00:17:06,530
electricity collecting the data that the

298
00:17:12,310 --> 00:17:08,300
experiments observe on-orbit

299
00:17:13,750 --> 00:17:12,320
and then taking that data and radioing

300
00:17:18,770 --> 00:17:13,760
it to the ground for the waiting

301
00:17:25,710 --> 00:17:22,949
he oh I will rotate slowly so that over

302
00:17:28,710 --> 00:17:25,720
a six month period of time we will scan

303
00:17:31,400 --> 00:17:28,720
the entire cosmos marking a map of all

304
00:17:34,770 --> 00:17:31,410
the x-ray objects that can be observed

305
00:17:39,900 --> 00:17:34,780
when that map from he Oh a is developed

306
00:17:42,540 --> 00:17:39,910
he OB will then be launched the he OB

307
00:17:44,310 --> 00:17:42,550
x-ray telescope will actually point at

308
00:17:47,400 --> 00:17:44,320
various objects that have been

309
00:17:50,670 --> 00:17:47,410
identified on he Oh a so they may be

310
00:17:53,190 --> 00:17:50,680
studied in great detail by correlating

311
00:17:55,410 --> 00:17:53,200
these x-ray observations were those of

312
00:17:58,410 --> 00:17:55,420
optical astronomers we will better

313
00:18:02,340 --> 00:17:58,420

understand these fascinating objects and

314
00:18:04,830 --> 00:18:02,350
events in our universe he OC will be

315
00:18:05,460 --> 00:18:04,840
launched in 1979 and be quite similar to

316
00:18:08,160 --> 00:18:05,470
Keowee

317
00:18:10,470 --> 00:18:08,170
it however will carry a cosmic and

318
00:18:13,210 --> 00:18:10,480
gamma-ray payload and again do an

319
00:18:17,500 --> 00:18:15,310
in the last few years we have began to

320
00:18:19,870 --> 00:18:17,510
increasingly realize the importance of

321
00:18:23,230 --> 00:18:19,880
explosive events occurring impulses

322
00:18:25,570 --> 00:18:23,240
black holes and lasers in the birth and

323
00:18:27,730 --> 00:18:25,580
death of stars and galactic system and

324
00:18:29,830 --> 00:18:27,740
in their evolution whenever these

325
00:18:31,660 --> 00:18:29,840
conditions occur in cosmic objects

326
00:18:34,000 --> 00:18:31,670
high-energy photons and eye energy

327
00:18:35,920 --> 00:18:34,010
particles are produced and this can best

328
00:18:37,720 --> 00:18:35,930
be detected with eye energy astronomy

329
00:18:40,300 --> 00:18:37,730
instrumentation therefore high-energy

330
00:18:42,610 --> 00:18:40,310
strongly is a particular role to play in

331
00:18:44,680 --> 00:18:42,620
the study of explosive events in the

332
00:18:46,650 --> 00:18:44,690
universe as a whole what we hope to

333
00:18:49,570 --> 00:18:46,660
achieve the National Observatory

334
00:18:52,150 --> 00:18:49,580
facility that will help us understand

335
00:18:54,280 --> 00:18:52,160
man's role in the universe and the

336
00:18:58,520 --> 00:18:54,290
sources of the energies and the

337
00:19:05,990 --> 00:19:02,480
we barely understand our universe once

338
00:19:08,870 --> 00:19:06,000

thought of place of quiet Majesty now is

339
00:19:11,660 --> 00:19:08,880
known to be a bursting hotbed of forces

340
00:19:16,340 --> 00:19:11,670
and energies more violence than we ever

341
00:19:20,030 --> 00:19:16,350
dreamed with he oh we are opening a new

342
00:19:23,200 --> 00:19:20,040
window to see this new universe face to