

1
00:00:08,250 --> 00:00:13,900
sometimes after a rainstorm one can see

2
00:00:11,800 --> 00:00:16,660
explicit evidence that the white light

3
00:00:13,900 --> 00:00:20,109
of the Sun is composed of all the colors

4
00:00:16,660 --> 00:00:22,480
of the rainbow examining this visible

5
00:00:20,109 --> 00:00:27,219
light spectrum one sees the familiar

6
00:00:22,480 --> 00:00:30,698
colors of red orange yellow green blue

7
00:00:27,219 --> 00:00:34,119
and violet but did you ever wonder if

8
00:00:30,699 --> 00:00:36,130
there are other colors colors beyond the

9
00:00:34,119 --> 00:00:40,629
red and violet ends of the visible light

10
00:00:36,130 --> 00:00:44,380
spectrum these non visible colors do

11
00:00:40,630 --> 00:00:46,740
exist light that has wavelengths longer

12
00:00:44,380 --> 00:00:50,710
than red includes the infrared

13
00:00:46,740 --> 00:00:53,230
microwaves and radio waves light that

14
00:00:50,710 --> 00:00:56,910
has higher energy than violet includes

15
00:00:53,229 --> 00:00:59,799
ultraviolet light x-rays and gamma rays

16
00:00:56,909 --> 00:01:03,549
all of these are different forms of the

17
00:00:59,799 --> 00:01:05,408
same phenomenon and because light is an

18
00:01:03,549 --> 00:01:08,170
oscillating wave of electric and

19
00:01:05,409 --> 00:01:11,229
magnetic fields this is called the

20
00:01:08,170 --> 00:01:13,030
electromagnetic spectrum in your

21
00:01:11,228 --> 00:01:16,420
everyday life you're probably familiar

22
00:01:13,030 --> 00:01:19,780
with many of these types of light the

23
00:01:16,420 --> 00:01:22,868
most common are radio waves this multi

24
00:01:19,780 --> 00:01:25,420
band radio receiver includes not only FM

25
00:01:22,868 --> 00:01:30,248
and AM bands but also several of these

26
00:01:25,420 --> 00:01:32,859
shortwave radio bands microwaves as you

27
00:01:30,248 --> 00:01:36,938
might expect are the radiation used to

28
00:01:32,858 --> 00:01:39,489
heat food in a microwave oven infrared

29

00:01:36,938 --> 00:01:42,638
light is commonly associated as heat

30
00:01:39,489 --> 00:01:44,818
radiation although visible light can't

31
00:01:42,638 --> 00:01:47,530
penetrate this smoke-filled room an

32
00:01:44,819 --> 00:01:52,569
infrared view sees the warm-blooded

33
00:01:47,530 --> 00:01:54,248
humans inside ultraviolet light is

34
00:01:52,569 --> 00:01:57,039
associated with being out in the

35
00:01:54,248 --> 00:02:00,068
sunshine one of the main advantages of

36
00:01:57,039 --> 00:02:02,859
sunglasses and sunscreen is to protect

37
00:02:00,069 --> 00:02:08,890
your eyes and skin from the ultraviolet

38
00:02:02,858 --> 00:02:11,409
or UV radiation of the Sun x-rays are

39
00:02:08,889 --> 00:02:13,629
common in medical situations because

40
00:02:11,409 --> 00:02:16,209
this high-energy radiation passes

41
00:02:13,629 --> 00:02:19,150
through skin and soft tissue one can

42
00:02:16,209 --> 00:02:20,379
examine the bones as shadows in an x-ray

43
00:02:19,150 --> 00:02:23,450

image

44

00:02:20,379 --> 00:02:25,750

gamma rays are the highest energy form

45

00:02:23,449 --> 00:02:27,919

of light and they're somewhat uncommon

46

00:02:25,750 --> 00:02:29,900

although they can be produced in

47

00:02:27,919 --> 00:02:32,629

lightning strikes they are more

48

00:02:29,900 --> 00:02:33,439

associated with nuclear reactions as in

49

00:02:32,629 --> 00:02:37,729

this Texas

50

00:02:33,439 --> 00:02:39,770

test explosion from many decades ago the

51

00:02:37,729 --> 00:02:42,799

electromagnetic spectrum includes all

52

00:02:39,770 --> 00:02:45,020

the various forms of light and in this

53

00:02:42,800 --> 00:02:48,520

diagram one can see that visible light

54

00:02:45,020 --> 00:02:51,080

is a relatively small portion of it

55

00:02:48,520 --> 00:02:53,750

naturally astronomers want to use as

56

00:02:51,080 --> 00:02:57,800

many types of light in examining the

57

00:02:53,750 --> 00:02:58,879

universe here we have four images of the

58
00:02:57,800 --> 00:03:01,550
Whirlpool Galaxy

59
00:02:58,879 --> 00:03:07,129
in four different types of light visible

60
00:03:01,550 --> 00:03:09,469
infrared ultraviolet and x-rays each of

61
00:03:07,129 --> 00:03:11,599
these different types of light shows us

62
00:03:09,469 --> 00:03:15,020
a different characteristic of the same

63
00:03:11,599 --> 00:03:17,719
object it is one of the great advances

64
00:03:15,020 --> 00:03:19,580
of the last century that astronomers now

65
00:03:17,719 --> 00:03:22,310
use every type of light across the

66
00:03:19,580 --> 00:03:24,760
electromagnetic spectrum in studying the

67
00:03:22,310 --> 00:03:24,759
cosmos

68
00:03:32,409 --> 00:03:34,469
you