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A Review of Galaxy classification by Hubble scheme

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ABSTRACT: A Galaxy is a system of a number of stars that are gravitationally held together and contain gas, dust, dark matter, planets, etc. Galaxy is very vast which is sometimes difficult or impossible to study. So to easily study them it is important to classify them. Classification means arranging things in a special order which makes them easy to study or understand them.

Edwin Hubble classified galaxies into Four main classes: Elliptical, Spiral, Lenticular, and Irregular galaxies which makes the galaxies easily study them based on their shapes. It is possible to define the Hubble scheme or Hubble sequence in terms of specific galaxy parameters. It shows the correlation between Galaxy morphology and measurable galaxy features.

KEYWORDS: Galaxies, Classification, Hubble classification, Galaxy parameters.

INTRODUCTION:

In 1926, Edwin Hubble an Astronomer discovered 10000 galaxies in the sky by using Hubble's telescope, the Hubble telescope has helped astronomers so much in the past three decades to gain a greater understanding of how galaxies form and develop, and Edwin Hubble created a diagram to classify galaxies, this diagram is also known as HUBBLE TUNING FORK DIAGRAM. This classification is mainly based on the shapes of the galaxies. Hubble used galaxy morphology to classify galaxies. The Hubble tuning fork diagram is also referred to as Hubble's scheme or Hubble's sequence or Hubble's classification of galaxies.

Hubble classifies galaxies into 4 classes: Elliptical Galaxies, Spiral Galaxies, Lenticular, and Irregular Galaxies.

Elliptical, Spiral, and Lenticular Galaxies are also referred to as regular galaxies because they have a symmetrical shape. These galaxies are further classified into subclasses. Each galaxy is classified based on their shapes like elliptical galaxies have an elliptical or circular shape, spiral galaxies have a spiral shape, lenticular may have both spiral and elliptical shapes, and irregular galaxies have an asymmetrical shape.

Today Hubble's classification is the most commonly used scheme to study galaxies and Hubble's sequence does not correspond to an evolutionary sequence of galaxies during different phases of their life.

Not only he classified galaxies but he also gives methods to measure the distance to galaxies or stars.

But we are not going to measure distances here we are going to study types of galaxies classified by Hubble using Hubble's Tuning Fork Diagram.

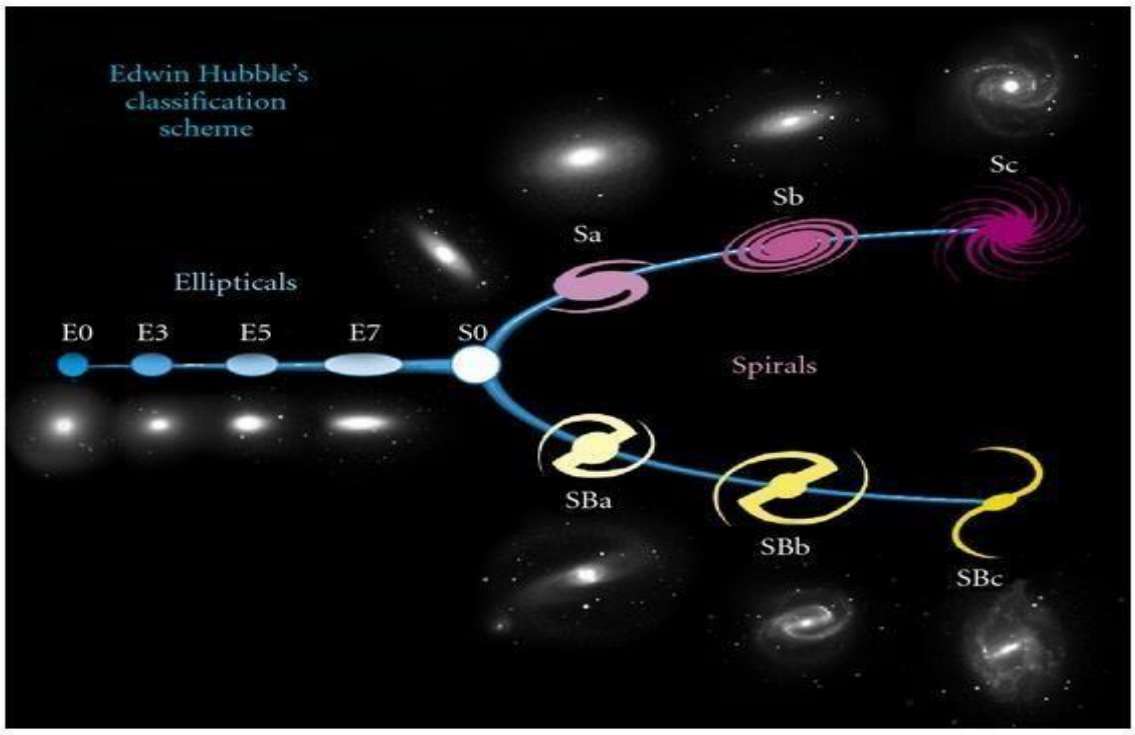
HUBBLE'S TUNING FORK DIAGRAM:

Hubble's Tuning fork diagram consists of :

Elliptical galaxies are indicated as "E0, E3, E5, and E7" Galaxies.

After elliptical galaxies, there are Lenticular galaxies indicated as "S0".

After Lenticular galaxies, there are Spiral galaxies which are indicated as " Sa, Sb, Sc" (Normal Spiral Galaxies) and "SBa, SBb, SBc" (Barred Spiral Galaxies).



PIC 1: HUBBLE TUNING FORK DIAGRAM

CLASSIFICATION OF GALAXIES:

On the basis of shape and Hubble tuning fork diagram Hubble classifies galaxies into 4 classes:

(1). ELLIPTICAL GALAXY

(2). SPIRAL GALAXY

(3). LENTICULAR GALAXY

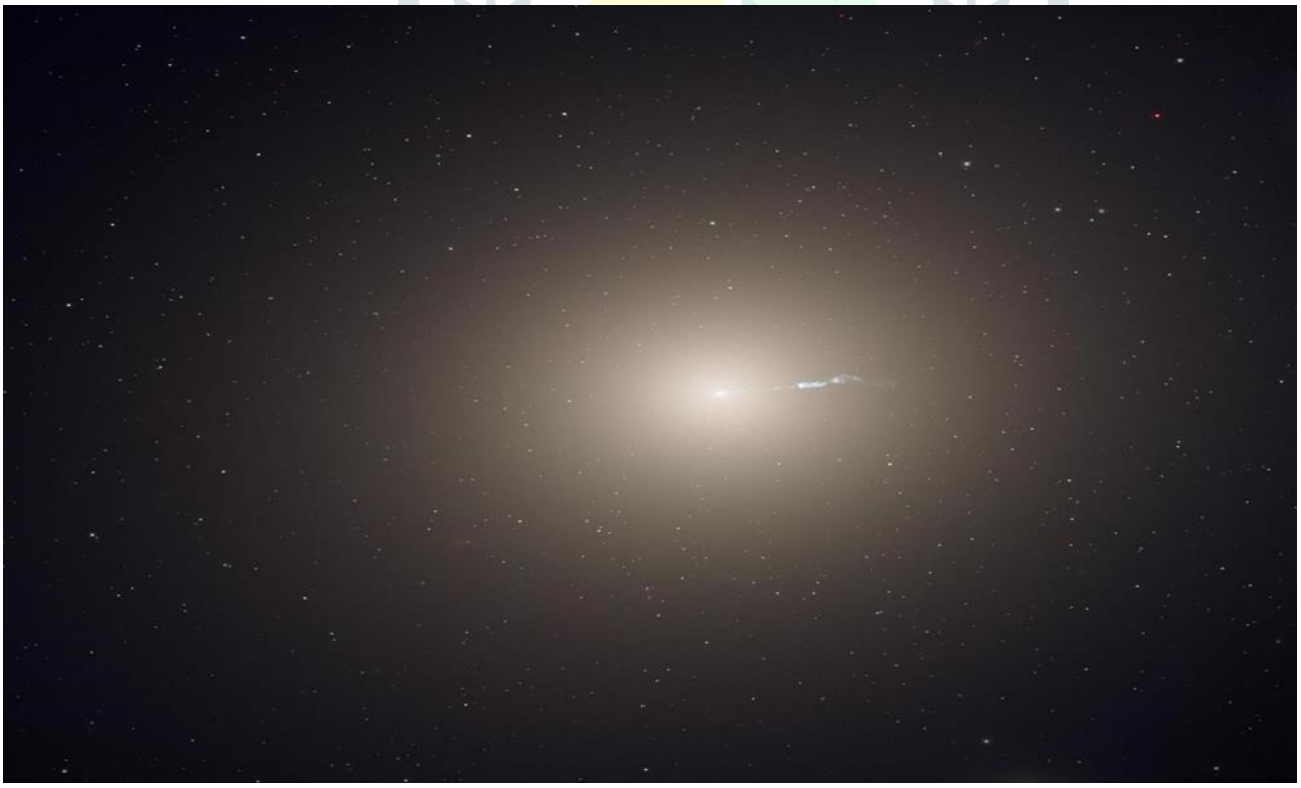
(4). IRREGULAR GALAXY

ELLIPTICAL GALAXY: Elliptical galaxies mostly appear elliptical and circular in shape. They are round and smooth and appear in a fuzzy ball of light. Elliptical galaxies are a collection of stars formed due to collision between two galaxies which are usually spiral galaxies. These galaxies do not contain spiral arms and disks which means they do not have spiral shapes but have elliptic or round shapes. They are red coloured galaxies that mostly contain older population stars. The age of stars in these galaxies is about 710 billion years old according to the stellar population. Hubble and astronomers believe that elliptical galaxies are the last stage of evolution.

Elliptical galaxies indicate in numbers and have subclasses:

E0, E3, E5, E7 where E0 appears in circular shape and E7 appears

elliptic in shape.



Pic. 2: MESSIAR 87 (M87) GALAXY

M87 is an example is an elliptical Galaxy and classified under E0 Subclass and lies about 55 million Light years away from Earth.

SPIRAL GALAXY: Spiral galaxies have spiral arms and thin outer disks which means these galaxies have spiral shapes. Spiral galaxies have circular symmetry and have complex structures which means they have a central bulge that lies at the centre of a rotating disk. The Centre of spiral galaxies is red in colour and has blue-coloured spiral arms This galaxy is surrounded by less populated halos. The age of stars in spiral galaxies is between 2-11 billion years old.

Spiral galaxies are further classified into 2 subclasses: Normal spiral galaxies and Barred spiral galaxies.

In a Normal spiral galaxy, the spiral arms are produced from the centre of the nucleus and are indicated as “Sa, Sb, Sc”.

In a Barred spiral galaxy, the bars are produced through the nucleus, and spiral arms are attached to the ends of the bars and are indicated as “SBa, SBb, SBc”. In research 65% of spiral galaxies have bars.

Pic.3 : NGC 1376 GALAXY

NGC 1376 galaxy is an example of a Normal spiral galaxy and lies about 180 million light years away from Earth.

Pic.4 : NGC 613 GALAXY

NGC 613 Galaxy is an example of a Barred spiral galaxy and lies about 67 million years away from Earth.

LENTICULAR GALAXY: These galaxies are also referred to as "S0" galaxies. These galaxies are almost circular in shape. Lenticular galaxies are the intermediate/transition between the elliptical and spiral galaxies. These galaxies have a bright nucleus with no spiral arms and disks and are the forking point in the Hubble galaxy scheme.

Lenticular galaxies contain stars that are about a billion years old.

Pic.5 : NGC 4111 GALAXY

NGC 4111 Galaxy is an example of a Lenticular galaxy and is lying about 50 million light years away.

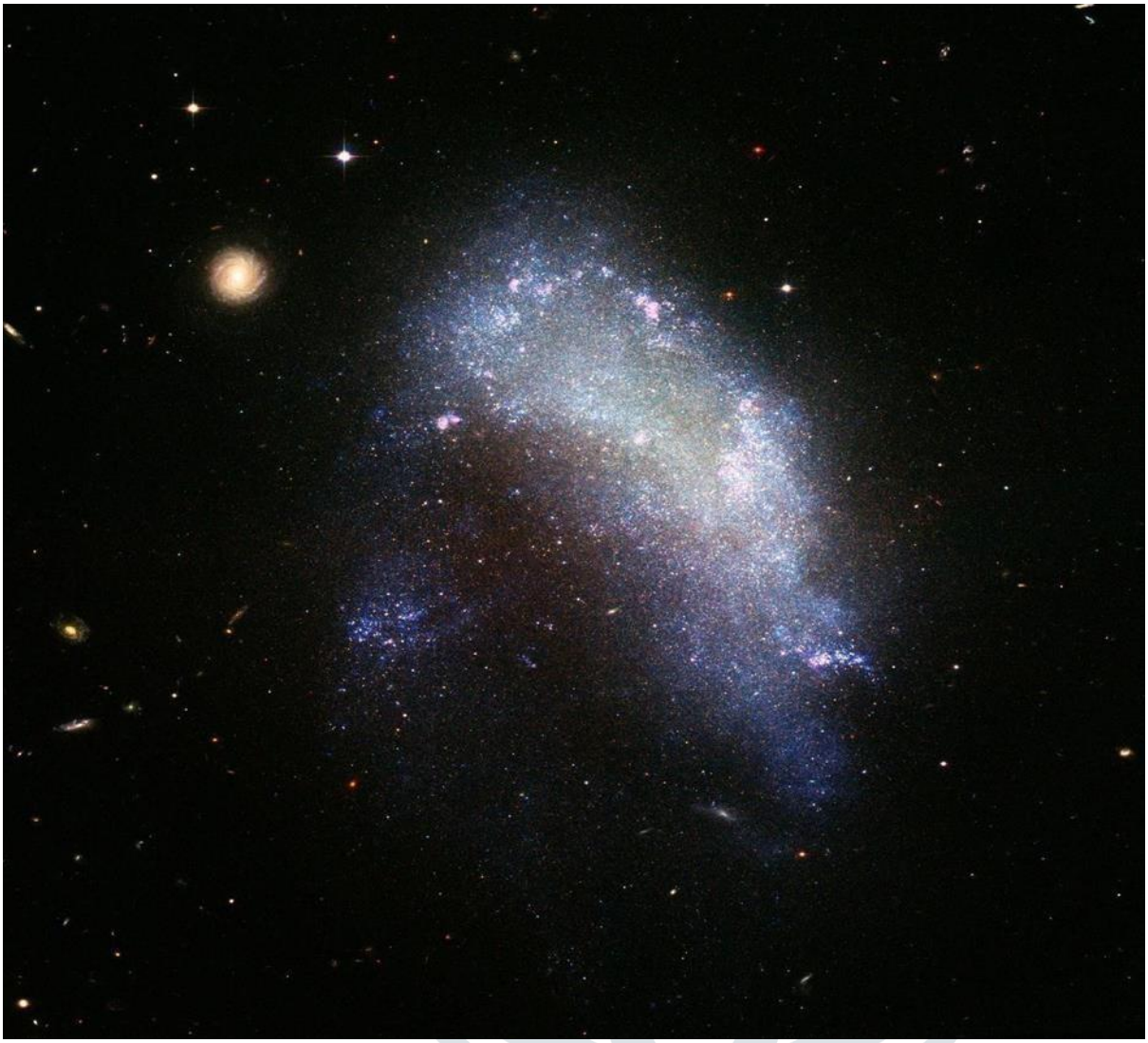
IRREGULAR GALAXY: Irregular galaxies have an asymmetrical shape which means they have no definite shape or structure and these galaxies are often chaotic and have no noticeable nucleus. Stars, gas, and dust in these galaxies are randomly organized. In many cases, they are thought to appear as spiral or elliptical galaxies but then they are gravitationally disturbed by a galactic collision passed by or being gravitationally influenced by a larger nearby galaxy. Irregular galaxies are often filled with lots of bright young stars. About 20% of galaxies are irregular galaxies in the universe.

Pic.6 : LHA 120_N11 in the LARGE MAGELLANIC CLOUDS

LARGE MAGELLANIC CLOUDS is an example of an irregular galaxy and lies about nearly 200000 light years away from Earth.

Irregular galaxies are further classified into 3 subclasses: Irr(I), Irr(II), and Dwarf irregular galaxies.

Irr(I): These irregular galaxies are closely related to spiral galaxies and often have disks and bulges but do not have a spiral shape and are blue in colour and are the most common form of an irregular galaxy.



Pic.7 : NGC 1427A GALAXY

NGC 1427A Galaxy is classified into Irr(I) galaxy of the irregular galaxy and lies about 62 million light years away from Earth.

Irr(II): These irregular galaxies do not have any definite shapes or structures as that of elliptical or spiral galaxies and due to lack of structure they do not place in Hubble's classification. They are red in colour and are rare irregular galaxies.

Pic.8 : MESSIER 82 (M82) GALAXY

M82 Galaxy is the Irr(II) type of galaxy of the irregular galaxy and lies nearly about 12 million light-years away from the Earth.

DWARF IRREGULAR GALAXY: This galaxy is also known as a Dwarf Phoenix galaxy and is the smallest irregular galaxy in the universe.

Their activity is mostly influenced by interactions with larger galaxies. Dwarf galaxies mostly contain young stars in their inner region.

Pic. 9: UGC 4459 GALAXY

UGC 4459 Galaxy is a type of Dwarf irregular galaxy and lies about approximately 11 million light years away from Earth.

CONCLUSION: After going through the whole classification it is concluded that there are so many galaxies that are classified under Hubble's classification and he makes it easier to understand or study the galaxies which are difficult to classify even under Hubble's scheme. Each and Every galaxy which is classified under this scheme is based on their shapes. Most importantly it is concluded that not every galaxy contains spiral arms and disks and some are also present without spiral arms and disks.

Every galaxy have a different shape, structure and features which makes them different from each other and makes it easier to classify them.

Nowadays Hubble's classification is the most used technique to classify galaxies and to study galaxies.

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