## Geography Class 04

### REVISION OF THE PREVIOUS CLASS (9: 05 AM):

- Seasons are observed on the earth because the earth revolves around the sun with a tilted axis of rotation whose angle of inclination is always constant.
- The change of seasons on the surface of the earth is mainly due to variation in the length of day and night, and the variation in the intensity of sunlight.
- Regions that are receiving higher intensity of sunlight for a longer duration of time experience summer and those receiving lower power of the sun for a shorter duration of time experience winter

### Equinox:

 It is the position of the earth where the earth's axis of rotation is neither tilted towards the sun nor away from the sun.

#### Summer solstice:

- 21 June- Sunrays fall vertically at 23.5 degrees north and decrease towards the north pole.
- All the places to the north of the equator receive higher sunlight intensity.
- The length of the day and night is 12 hours at the equator.
- The length of the day increases from the equator to the north pole.

# Winter Solstice:

- 22<sup>nd</sup> December- Sunrays fall vertically at 23.5 degrees south and decrease to the south poles.
- All the places to the north of the equator receive sunlight at a lower intensity.
- The length of the day is 12 hours along the equator and it decreases from the equator towards the north pole.

### Equinox:

- During the equinox, the sun's rays fall vertically at the equator.
- All the latitudes towards the north and south of the equator receive an equal duration of day and night.
- The Spring equinox is on the 21<sup>st</sup> of March and the Autumn equinox is on the 23<sup>rd</sup> of September.
- Sun rays fall vertically on the Equator. All the latitudes experience an equal duration of day and night.

#### Overhead sun:

- The position of the overhead sun varies between the Tropic of Cancer and the Tropic of Capricorn.
- Every place located in the tropics receives 90 degrees of sunlight for two days a year.
- And those which are located exactly in the tropics receive 90 degrees of sunlight for 1 day a year.

#### Time zones in different countries:

- Any country generally prefers to stay in a single time zone for administrative and technical convenience.
- France has the highest number of time zones- 12.
- USA and Russia have 11 time zones.

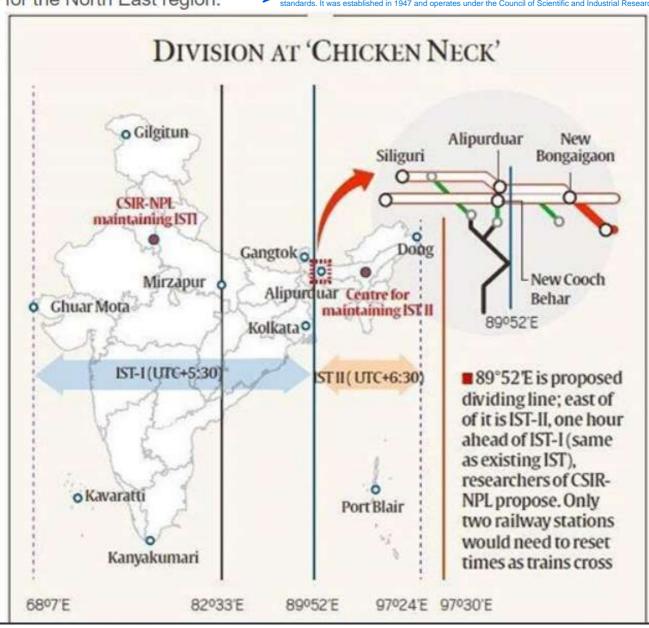
#### Indian Standard Meridian:

- The Indian Standard Meridian passes through 82.5 degrees east- Mirzapur, Uttar Pradesh.
- The longitudinal extent of India is about 30 degrees from east to west- 2933 kilometers, which sums up to around two hours of time.
- Considering the longitudinal extent, India should have more than one time zone to maximize the solar daytime.

#### India and different time zones:

- India used to have three time zones till 1906- Bombay, Madras, and Calcutta time zones.
- India also had a local Chai Bagan Time in Assam.
- In 1906, India adopted 82.5 degrees East longitude as its standard meridian.
- Local times of Calcutta and Bombay continued till 1955.
- Even the National Physical Laboratory has recommended a separate time zone for the North East region.

  The National Physical Laboratory (NPL) is India's premier research institution for physical sciences and measurement standards. It was established in 1947 and operates under the Council of Scientific and Industrial Research (CSIR).



## ISSUES WITH MULTIPLE TIME ZONES (9:30 AM):

- · Issues with economic integration through banking trade stock markets etc.
- Issues in synchronization of transportation such as railways.
- Administrative convenience- timings of government offices, schools, and offices, etc.
- · Security issues- better communication.

# Calculating time at different places:

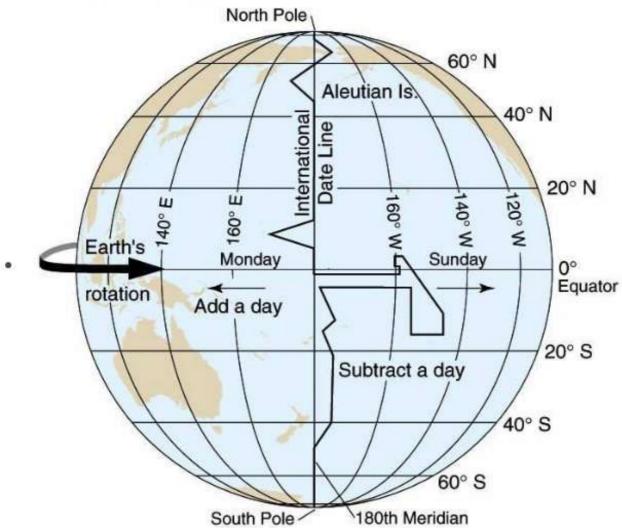
- If the time in Mirzapur is 6 PM, what is the present time at Toronto at 77.5 degrees west longitude?
- · Approach:
- We need to first find the difference in latitudes.
- Mirzapur(82.5 degrees east) and Toronto(77.5 degrees west) are 160 degrees apart.
- The 1-degree difference is of around 4 minutes.
- 160 degrees will give us a difference of 10 hours & 40 minutes(640 minutes).
- We need to go back in time by 10 hours 40 minutes because we are moving from East to West.
- Hence we will get 7:20 AM.

# International Date Line(IDL):

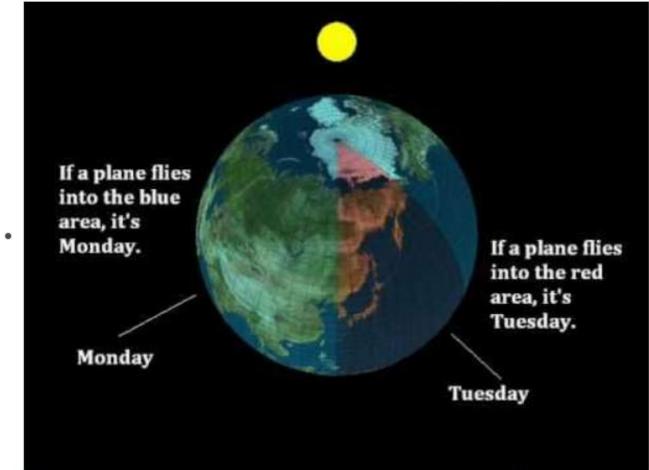
- It is an imaginary line of demarcation running from the North Pole to the South Pole.
- · It demarcates the change of calendar day.
- · It was agreed upon in 1884.

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- The IDL roughly follows 180 Degrees East /180 Degrees West longitude.
- It is not a straight line and it follows a slightly zig-zag path to accommodate the islands in the Pacific Ocean.
- A linear IDL would have meant that there would have been two different dates for the same island.
- It is the line where the date changes exactly by one day when crossed.
- When a traveler crosses it from East to West, a day is lost.
- When a traveler crosses it from West to East, a day is gained.

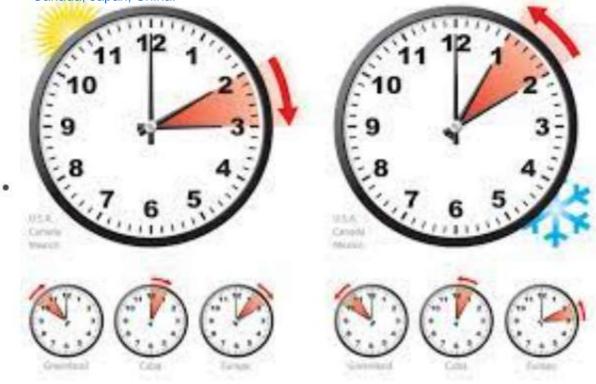


The east, and west used above is with references to the IDL only.

## DAYLIGHT SAVING TIME (10:10 AM):

- The clocks are forwarded in summer for better use of natural light and conservation of energy, particularly during the evening.
- It is mainly practiced in temperate countries with a sufficient variation of day length between summer and winter.
- Normally in winter daylight period is much shorter, and the night is much longer.
- Whereas in summer, the daylight period is much longer, and nights are shorter.

• Temperate Countries:- Which are in between the latitude from 23.5 degree and 66.5 degree . ex:- North America, Canada, Japan, China.



## **Example of Daylight Saving Time:**

- Our aim remains that the office employees spend the day in the office, while it is still daytime, as the productivity gets higher.
- We assume that the office timings will remain same all round the year.
- Assume that the common office timings are 10 AM-6 PM, and the average times of sunrise and sunset are 5 AM and 6 PM.
- During winter, in the northeast, the sun will rise at 6 AM and it may set at 5 PM.
- So if the office timing is still 10
   AM-6 PM, the workers will work
   for one hour (5 PM-6 PM) when it
   will be night, and their
   productivity will be less.
- But if we set the watches of northeast backward by one hour, it will show 6 PM there, even when actually it would be 5 PM as per Indian standard time.
- So even that one hour would be utilized, and people will work in the office while still there is still day.

## MILANKOVITCH CYCLES (10:30 AM):

- The cyclical changes observed during the earth's circumnavigation around the sun are called Milankovitch cycles.
- · It involves variations in :
- I. Eccentricity: Shape of the earth's robot around the sun.
- It is visible after around 1 lakh years.
- . II. Obliquity: Inclination of the earth's axis.
- It is visible after around 41 thousand years.
- III. Precession: Earth's slow wobble during its spinning motion.
- It is visible after around 26 thousand years.

CHANGES IN AXIAL PROCESSION (WOBBLE) IN A 26,000-YEAR CYCLE

CHANGES IN ECCENTRICITY (ORBIT SHAPE) IN A 100,000-YEAR CYCLE

CHANGES IN OBLIQUITY (TILT) IN A 41,000-YEAR CYCLE

CYCLE

## Impact of these cycles:

- The severity of seasons changes due to variations in the amount of sunlight received on the earth.
- Long-term climatic changes.

### UNIVERSE (11:00 AM):

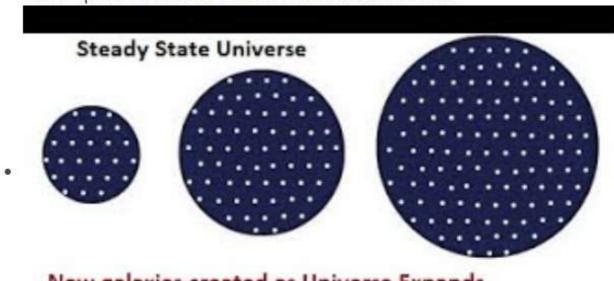
- The universe is the limitless expanse of all of space, and all the matter around us.
- It consists of the solar system, stars, galaxies, dark matter, dark energy, etc.
- There are estimated 100-400 billion galaxies, and each galaxy has around 100-400 billion stars.
- Proxima Centauri is the second nearest star in our galaxy which is 4.2 light years away.
- It could take around 25000 years to reach Proxima Centauri.
- · There have been various theories regarding the origin of the universe:

### Steady State Theory:

It was proposed by Fred Hoyle.

The Steady State Theory is an astronomical theory about the origin and nature of the universe. It proposes that the universe has no beginning or end in time and maintains a constant, unchanging appearance. According to this theory, as the universe expands, new matter is continuously created to fill the space left by galaxies moving apart.

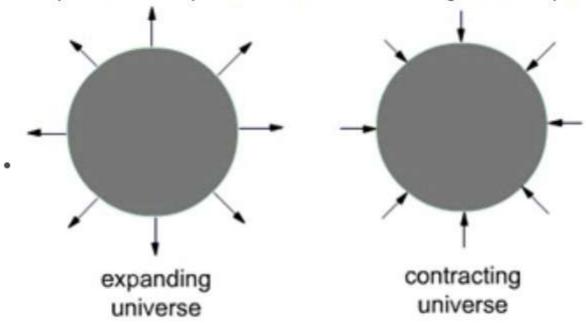
- The theory says that the overall size and mass of the universe remain constant at any point in time.
- The universe has no beginning and no end.
- In this Universe model, matter is always created to form galaxies and stars at the same speed as the old ones become unobservable.



New galaxies created as Universe Expands

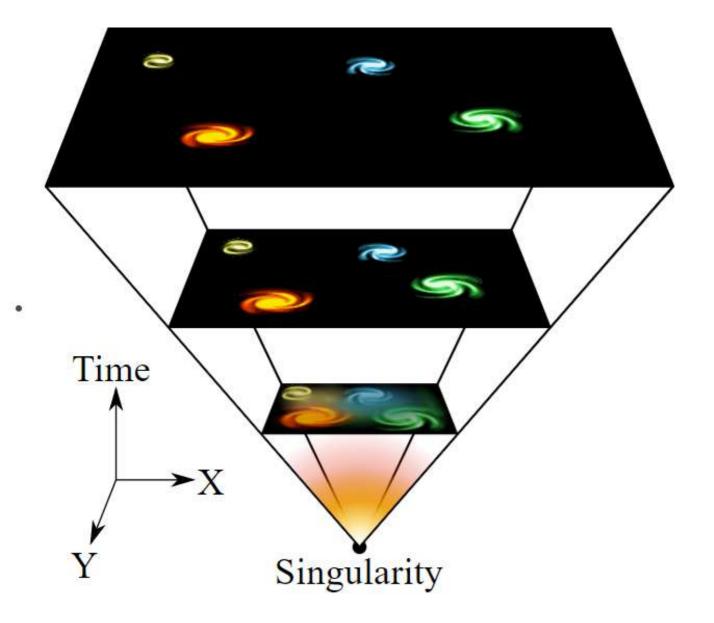
# **Pulsating Theory:**

- It was proposed by Arthur Eddington.
- Even this theory suggests that the universe has no beginning and no end.
- The theory suggests that the universe expands and contracts alternatively.
- · It expands due to explosion and it contracts due to gravitational pull.



## BIG BANG THEORY (11:30 AM):

- It was first proposed by Georges Lemaitre in 1927.
- · The universe started as a very hot and dense point known as the singularity.
- There was no other space and time.
- 13.7 billion years ago, a cosmic explosion called the big bang happened.
- The name "Big Bang" was coined by Fred Hoyle.
- Fred Hoyle's steady state theory was actually given by him in opposition to the big bang theory.



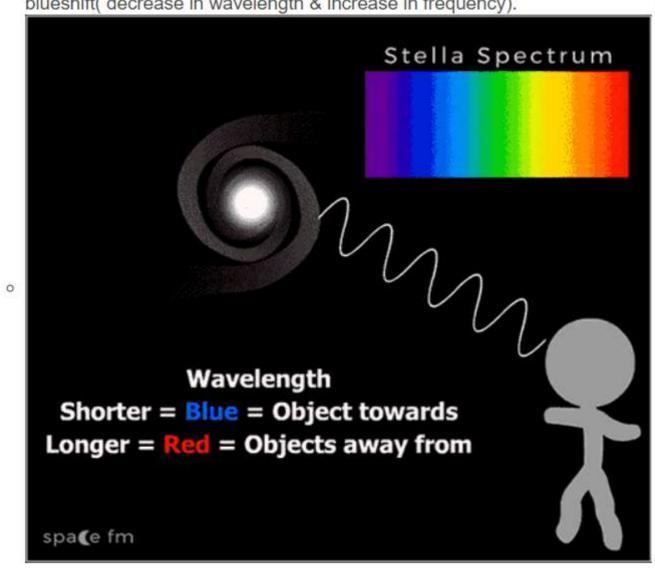




- · Evidence for the theory was given by Hubble.
- For the evidence, the concept of the Doppler effect in light was used.

# Doppler Effect in light:

- This refers to the change in the observed frequency of light caused by the relative movement between the emitter of the light and the observer of the light.
- This can be seen through the red shift and blue shift.
- When an object is moving away from us, the light from the object gives us a redshift(increase in wavelength & decrease in frequency).
- When an object is moving towards us, the light from the object gives us a blueshift( decrease in wavelength & increase in frequency).



- After the big bang, the universe started to expand and is still continuing today.
- The expansion subsequently led to the forces of physics, elementary particles, atoms, molecules, gaseous clouds, stars, and galaxies.
- Hubble in 1929 proposed that all observable stars and galaxies are moving away from the Earth.
- This was observed through the redshift observed from faraway stars
- The rate of expansion of the universe is not constant, and it is called **Hubble's** constant.

## Cosmic Microwave Background:

- It is the evidence supporting the big bang theory.
- It refers to faint uniform radiation that permeates the entire universe and originated after the big bang.
- As the universe expands, this radiation has undergone a redshift to a microwave range.

The topics for the next class are Stars, Galaxies & Solar systems