



# Efficacy of protective masks

**Airborne transmission is the dominant route for the spread of COVID-19**

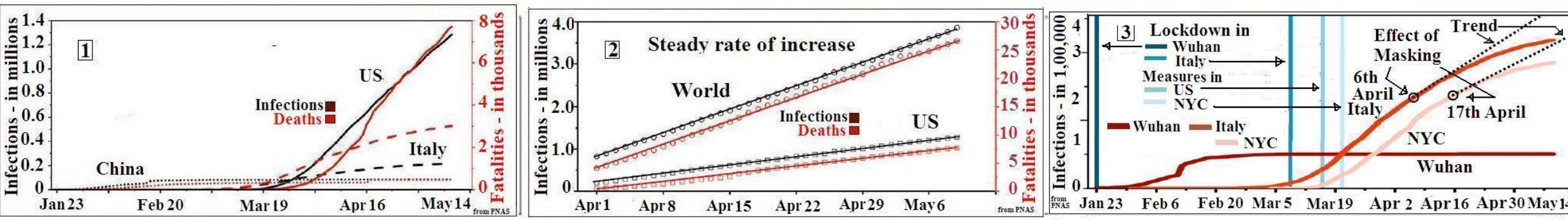
5 AVANTI TRIVAKAVANAN

**O**f all the measures that have been taken to control the spread of Covid-19, the use of masks has been found to be the most important. The reason China was able to control the disease so well may be because of the fact that the Chinese are used to wearing masks, thanks to poor air quality, says the lead author of a study of the world's efforts to halt Sars-CoV2.

Renyi Zhang, Yixin Lib, Annie L Zhang, Yuan Wang, and Mario J Molina, from the Texas A&M University, University of Texas at Austin, Caltech, Pasadena and University of California, San Diego describe in the journal, *Proceedings of the Academy of Science*, their finding that "airborne transmission via respiratory aerosols represents the dominant route for the spread of Covid-19."

The journal, *Science*, had recently carried a report about the size of droplets that a person infected with Covid-19 sends out when she speaks or coughs. The report said the smaller droplets evaporated and released the virus as an aerosol, or a mist that stayed airborne for hours. The group writing in PNAS has analysed the measures taken, from time to time, in China, Italy, New York and the US, and it finds that the use of masks is the crucial step and does the most to block the spread of the virus.

"Our analysis of the trend and mitigation measures in Wuhan, China, Italy, and New York City, from 23 January to 9 May 2020, reveals that the difference with and without mandated face covering represents the determinant in shaping the pandemic trends in the three epicentres. This protective mea-



sure alone significantly reduced the number of infections, that is, by over 78,000 in Italy from 6 April to 9 May and over 66,000 in New York City from 17 April to 9 May," says the paper in PNAS.

The study is centred on the trend of confirmed infections and confirmed deaths from Covid-19 from 23 January to 9 March 2020. The report recalls that the outbreak emerged during December 2019 in Wuhan, China and the numbers in China dominated the global trend during January and February 2020, as can be seen from the first graph. From February, however, the rise of newly confirmed cases and fatalities in China almost flattened. In contrast, the numbers in other countries show a sharp increase from the beginning of March.

The epicentre shifted from Wuhan to Italy in early March and to New York City in early April. By 30 April, the numbers of confirmed Covid-19 cases and deaths, respectively, reached over 200,000 and 27,000 in Italy and over 1,000,000 and 52,000 in the US, compared to about 84,000 and 4,600 in China. We can see from the graph that the curves in Italy exhibit a slowing trend from mid-April, while the numbers in the world and the US continue to increase. The second graph shows that right through April and into May, the trends in the numbers of infections

and fatalities in the world and in the US followed a uniform rate of increase. The curve flattening in China can be attributed to extensive testing, quarantine, and contact tracing, and then aggressive measures of lockdown of all cities and rural areas in the whole country, isolation of residents having close contact with infected people, and mandated wearing of facemasks in public. How effective the mitigation measures were has not been rigorously evaluated, and making out which measure was more effective is challenging, the report says, since all measures were implemented at the same time in January 2020. In Italy also, the measures of quarantine, isolation and city lockdown were implemented, right from 9 March. But we can see that the numbers kept rising, at least until mid-April. In most of the US too, social distancing, quarantine and isolation was started in March and April, on 22 March in New York City. But the continuous rise in infections makes it evident that the measures were not effective. The difference in Italy and the US, in contrast with China, is that using facemasks was not ordered and was not common during the early stages of the pandemic. WHO issued the guideline only on 6 April. Face masks were ordered in northern Italy on the same day and nation-wide on 4 May. It was ordered in

New York on 17 April. Unlike in China, where social distancing and masking were introduced simultaneously, the measures were introduced many weeks apart in Italy and New York. The change in the infection trend can thus be made out, to see the effect of masking. The third graph brings out the timing of the different measures, and their effects.

The paper notes that methods of physical separation, like social distancing, etc, would prevent direct contact transmission – but do not seem to prevent infection through inhalation of virus-bearing aerosols, which can disperse through smaller droplets at shorter distances. While we can see the downward turn with the introduction of masks, the dotted lines show where the linear trend would have led – and statistical methods have estimated the number of infections prevented by masking. "With social distancing, quarantine, and isolation in place worldwide and in the US since the beginning of April, airborne transmission represents the only viable route for spreading the disease, when mandated face covering is not implemented. Similarly, airborne transmission also contributes dominantly to the linear increase in the infection prior to the onset of mandated face covering in Italy and NYC. Hence, the unique function of face covering to block atomisation and

inhalation of virus-bearing aerosols accounts for the significantly reduced infections in China, Italy, and NYC, indicating that airborne transmission of Covid-19 represents the dominant route for infection," the report says.

**Implications for India**

The situation in India is different in the sense that there are concentrations, like slums, which we do not see in the West. For all that, there is alarming rise in numbers even 85 days after total lockdown. The report in PNAS cites a recent finding that "the highest viral load in the upper respiratory tract occurs at the symptom onset, suggesting the peak of infectiousness is on or before the symptom onset." While India has a problem of crowding and numbers to handle, that major role of airborne transmission by asymptomatic carriers in spreading the infection is an indicator of the direction that we should take. There was marked decline in the progress of the disease in Italy and New York, with the introduction of masking. Ensuring the discipline of masking, especially in places with concentration of people, seems to be the path that India should follow, to get that rising curve to flatten out.

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PLUS POINTS

## LESS ALONE THAN THOUGHT

There could be more than 30 alien civilisations in our galaxy, researchers have found in a major study.

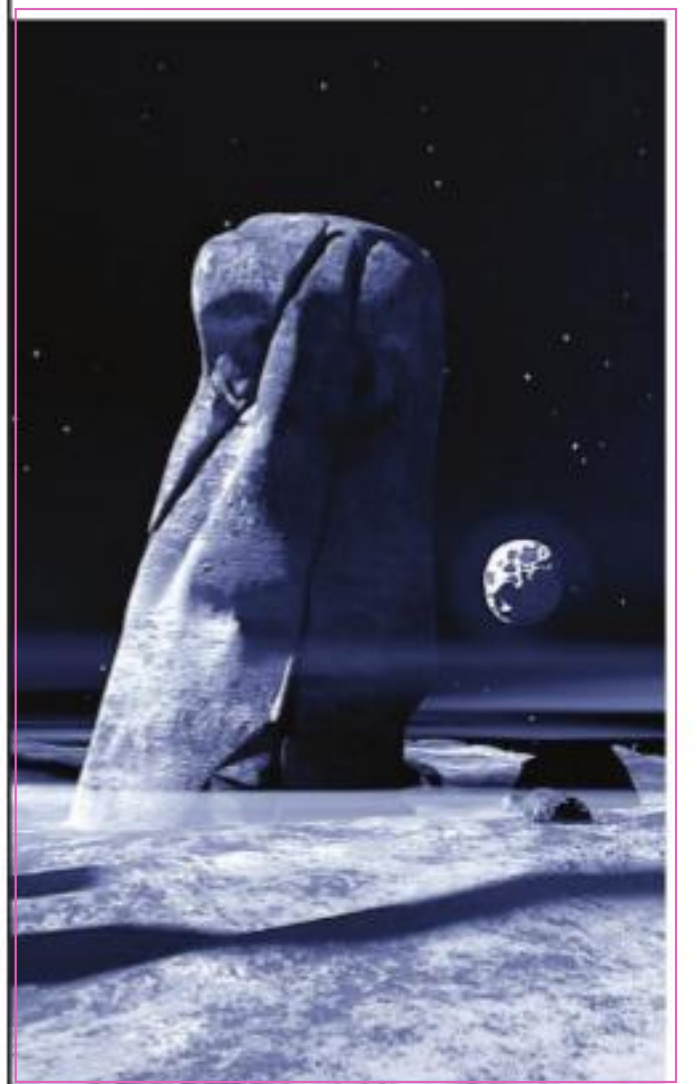
A new paper looked to understand how many planets in our neighbourhood could be home to alien life, by assuming that life develops on other planets in a similar way to how it develops on Earth, and matching that to planets that could be home to similar evolution.

It found that there could be dozens of active civilisations waiting to be found in our Milky Way. But it could also shed light on our own fate, and suggest our prospects for long-term survival are lower than we may have thought.

"There should be at least a few dozen active civilisations in our Galaxy under the assumption that it takes five billion years for intelligent life to form on other planets, as on Earth," Christopher Conselice of the University of Nottingham said in a statement. "The idea is looking at evolution, but on a cosmic scale. We call this calculation the Astrobiological Copernican Limit."

The Astrobiological Copernican limits come in two forms. One is the "weak" limit, which suggests that intelligent life forms on a planet any time after five billion years. The other is the "strong" limit where life formed between 4.5 billion and five billion years ago.

The new research used the latter, and also assumed that these new species would need to develop in metal-rich environments. This is because human beings developed near a metal-rich environment, due to the metal present in the Sun. Previous research from 2012 suggests a suitable "minimum stel-



# Rare celestial occurrence

**Here's a factfile on the annular solar eclipse that is set to awe observers across the world on 21 June**

BIPASH DAS GUPTA

**A**n annular solar eclipse will be visible on 21 June when the Moon passes between the Sun and Earth, thereby almost totally or partially obscuring the face of the solar disc as viewed from Earth. The word "annular" comes from the Latin word for ring which is "annulus" and the crossing of the Moon will form a "Ring of Fire". It will be visible beginning in Africa and crossing into Asia providing a cosmic spectacle to billions of observers.

Phenomena will begin at dawn this Sunday in the Democratic Republic of Congo, followed by an eastward journey across the Central African Republic, South Sudan and Ethiopia before crossing the Red Sea into Yemen, Saudi Arabia and Oman. The annularity path will proceed over the Gulf of Oman and enter Pakistan before crossing into northern India where the maximum duration will be about 39 seconds in the vicinity of Nanda Devi National Park in Uttarakhand, although partial phases of the eclipse will be visible throughout India. After grazing over the Himalayas, the annularity path will enter the Tibetan Plateau and will continue its journey through China and the Philippine Sea after passing over Taiwan. The eclipse will end at sunset near the island of Guam.

**How does it occur?**

When an opaque body comes in front of a light source, a shadow is produced in the same shape of the object. In this case, the Sun is the source of light whereas Earth and Moon are opaque bodies. When the lunar disc comes in front of the solar disc as seen from Earth, the shadow

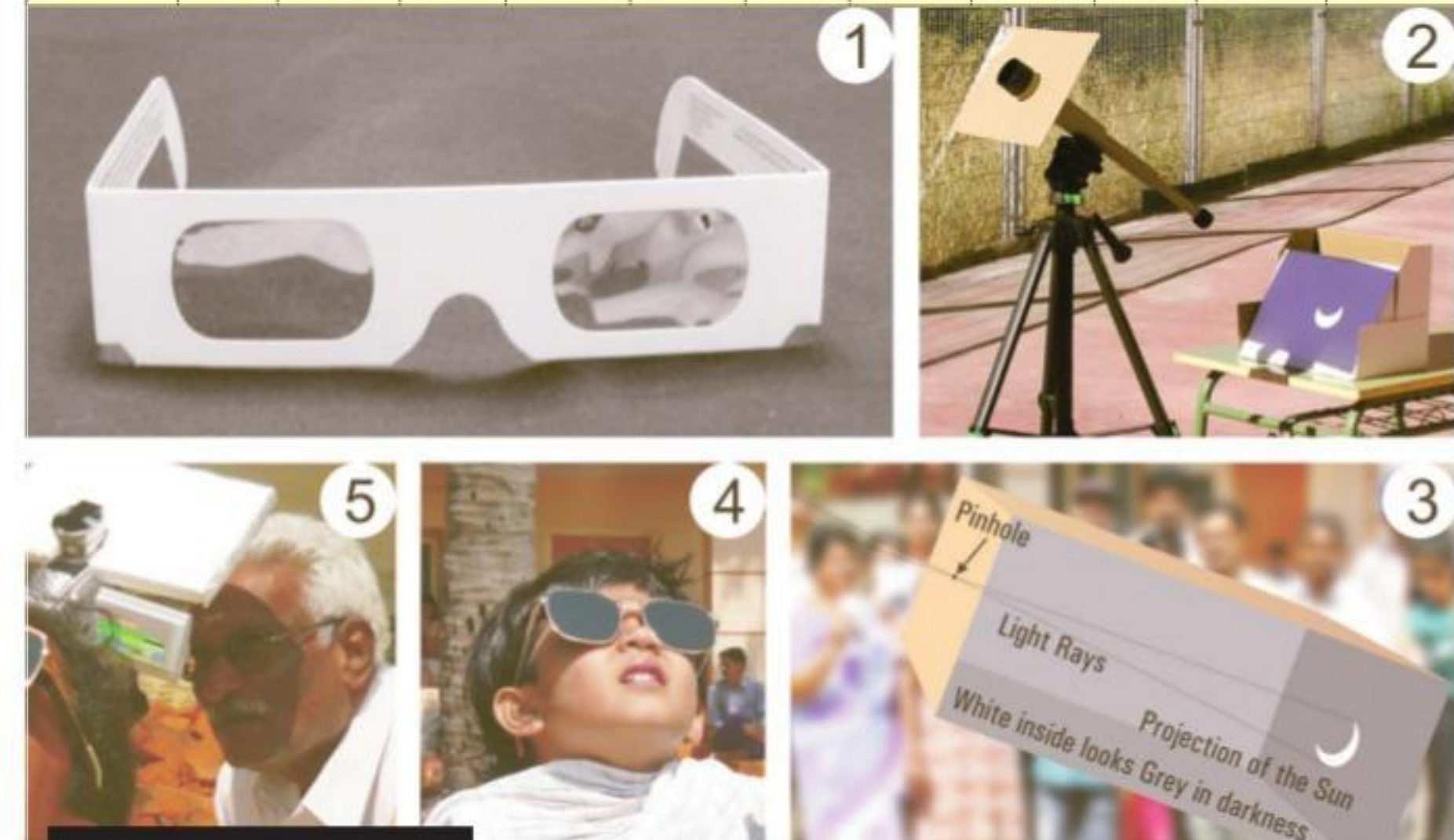
produced by the Moon has two regions of which no direct sunlight is able to penetrate into one. This total dark area is termed the umbra. Regions on either side of the umbra, wherein diffused sunlight from the illuminated periphery of the solar disc persists, are called penumbra. To an observer who remains within the umbra region, the solar disc is completely covered by the lunar disc. The annularity or "Ring of Fire" formation can only be seen in this area. Whereas for an observer within the penumbra areas, the lunar disc will appear to be projected partly onto the solar disc producing a partial phase.

The diameter of the Sun is 400 times bigger and also about 400 times away from Earth compared to the Moon. The distance between Earth-Moon and Sun-Earth varies owing to their elliptical orbits and the apparent relative distance between the three bodies varies slightly during the year. If the lunar disc is centred against the solar disc, while the Earth is nearest to the Sun, then the Moon is unable to cover the full solar disc. The apex of a shadow cone forms away from the Earth, thereby causing an annular solar eclipse.

**Contacts of annular solar eclipse**

- 1st contact: Partial phase begins as the lunar disc takes the first bite on western edge of the solar disc.
- 2nd contact: Instant lunar disc completely enters into the solar disc. A few seconds before annularity starts, Baily's beads, like beads of light, can sometimes be seen at the edge of the Moon's silhouette.
- Maximum eclipse: Black lunar disc will be positioned on the centre of solar disc. "Ring of Fire" appears.
- 3rd contact: Annularity ends as the lunar disc starts moving away from the solar disc. Baily's beads may be visible along the Moon's leading edge.
- 4th contact: Partial phase ends as the lunar disc takes the last bite on eastern edge of the solar disc. The lunar disc emerges out of the solar disc.

| PREDICTED TIMINGS OF THE ECLIPSE |          |           |                |                   |                  |            |           |                 |              |                     |                  |
|----------------------------------|----------|-----------|----------------|-------------------|------------------|------------|-----------|-----------------|--------------|---------------------|------------------|
| PLACES                           | LATITUDE | LONGITUDE | ECLIPSE BEGINS | ANNULARITY BEGINS | GREATEST ECLIPSE | ALTIMITUDE | MAGNITUDE | ANNULARITY ENDS | ECLIPSE ENDS | ANNULARITY DURATION | ECLIPSE DURATION |
|                                  | ° N      | ° E       | h:m:s          | h:m:s             | h:m:s            |            |           | h:m:s           | h:m:s        | m:s                 | h:m:s            |
| <b>PARTIAL PHASE</b>             |          |           |                |                   |                  |            |           |                 |              |                     |                  |
| NEW DELHI                        | 28°39'0" | 77°13'0"  | 10:20:01       | Partial Phases    | 12:01:39         | -          | 0.953     | Partial Phases  | 13:48:36     | -                   | 3:28:36          |
| KOLKATA                          | 22°35'0" | 88°23'0"  | 10:46:21       | Partial Phases    | 12:35:43         | -          | 0.726     | Partial Phases  | 14:17:19     | -                   | 3:30:58          |
| MUMBAI                           | 18°58'0" | 72°50'0"  | 10:00:46       | Partial Phases    | 11:37:41         | -          | 0.698     | Partial Phases  | 13:27:50     | -                   | 3:27:04          |
| CHENNAI                          | 13°04'0" | 80°15'0"  | 10:21:59       | Partial Phases    | 11:58:53         | -          | 0.455     | Partial Phases  | 13:41:24     | -                   | 3:19:25          |
| BANGALURU                        | 12°58'0" | 77°35'0"  | 10:12:58       | Partial Phases    | 11:47:37         | -          | 0.473     | Partial Phases  | 13:31:44     | -                   | 3:18:45          |
| HYDERABAD                        | 17°26'0" | 78°27'0"  | 10:14:43       | Partial Phases    | 11:55:42         | -          | 0.601     | Partial Phases  | 13:44:05     | -                   | 3:29:22          |
| AHMEDABAD                        | 23°02'0" | 72°36'0"  | 10:03:43       | Partial Phases    | 11:42:03         | -          | 0.821     | Partial Phases  | 13:32:15     | -                   | 3:28:32          |
| NAGPUR                           | 21°09'0" | 79°05'0"  | 10:17:35       | Partial Phases    | 12:01:27         | -          | 0.710     | Partial Phases  | 13:50:49     | -                   | 3:33:14          |
| AGARTALA                         | 23°49'0" | 91°17'0"  | 10:55:52       | Partial Phases    | 12:45:15         | -          | 0.768     | Partial Phases  | 14:23:54     | -                   | 3:28:01          |
| <b>ANNULARITY PHASE</b>          |          |           |                |                   |                  |            |           |                 |              |                     |                  |
| GHARSANA (RAJASTHAN)             | 29°01'6" | 73°04'8"  | 10:12:26       | 11:50:00          | 11:50:19         | 78         | 0.996     | 11:50:35        | 13:36:56     | 00:35               | 3:24:30          |
| SURATGARH (RAJASTHAN)            | 29°19'0" | 73°57'0"  | 10:14:28       | 11:52:34          | 11:52:53         | 78         | 0.998     | 11:53:13        | 13:39:27     | 00:39               | 3:24:59          |
| SIRSA (HARYANA)                  | 29°32'0" | 75°07'0"  | 10:16:00       | 11:55:54          | 11:56:11         | 80         | 0.995     | 11:56:27        | 13:42:44     | 00:33               | 3:26:42          |
| KURUKSHETRA (HARYANA)            | 29°57'3" | 76°52'9"  | 10:21:08       | 12:01:28          | 12:01:43         | 82         | 0.996     | 12:02:03        | 13:47:32     | 00:35               | 3:26:24          |
| DEHRADOON (UTTARAKHAND)          | 30°19'0" | 78°03'0"  | 10:24:04       | 12:05:06          | 12:05:18         | 82         | 0.995     | 12:05:30        | 13:50:35     | 00:24               | 3:26:31          |
| JOSHIMATH (UTTARAKHAND)          | 30°33'0" | 79°34'0"  | 10:27:39       | 12:09:38          | 12:09:55         | 83         | 0.996     | 12:10:13        | 13:54:27     | 00:35               | 3:26:48          |



1. Mylar sheet protected spectacle
2. Projection with telescope
3. Pin-hole projection using cardboard box
4. Welder's glass of Shade Number 14 fitted with sunglasses. Safe for children too
5. Projection on a camera fitted with a LCD screen

**SAFE VIEWING MEASURES**

- DO'S**
- Use proper solar filter bearing the appropriate optical density against solar radiations to be used, both for optical devices and eyes.
  - Welder's Glass of Shade Number 14 is a safe material as solar filter for directly viewing the solar disc. It can be used in front of the optical device, but not for long durations.
  - Pinhole projection method is the safest way to view the solar disc while eclipse is in progress. Projection using a telescope is also a safe way.
  - Aluminised Mylar sheet as filter or lens coated with black polymer is the safest possible material for viewing the solar disc.
- DON'TS**
- Do not use unsafe filters like smoked glass, polarising filter, sunglasses, photographic neutral density filters, colour film, black and white film not containing silver, film negatives with image.
  - Do not look at the Sun for even a little while without prior protection.
  - Do not use any said safe filter when they are not in best condition. Like scratched or folded Mylar sheet and B/W film negatives. Avoid Mylar sheet and B/W negatives, if any hole is found on them.
  - Reflected images are equally harmful as seeing the Sun directly with bare eyes.

lar metallicity" required for the formation of planets that would be similar to Earth.

Researchers were then able to use those assumptions about where life may form to understand how many planets in our Milky Way would be able to satisfy those conditions. Detecting any civilisations in our galaxy is strongly dependent on how well we can pick up signals being sent into space.

These include radio transmissions from satellites and television. If these technological civilisations last as long as ours, which has been sending out signals for the last century or so, then it is estimated there could be 36 ongoing intelligent civilisations.

While that might be the case, interacting with them would be difficult. The average distance to any possible civilisation would be 17,000 light years, which makes communication very challenging.

The other scenario is that we are the only intelligent life in the galaxy, and that civilisations die out before we can detect them.

"Our new research suggests that searches for extraterrestrial intelligent civilisations not only reveals the existence of how life forms, but also gives us clues for how long our own civilisation will last," Conselice said, "If we find that intelligent life is common then this would reveal that our civilisation could exist for much longer than a few hundred years, alternatively if we find that there are no active civilisations in our Galaxy it is a bad sign for our own long-term existence. By searching for extraterrestrial intelligent life – even if we find nothing – we are discovering our own future and fate."

The new study was led by the University of Nottingham and published this Monday in *The Astrophysical Journal*.

This is not the only recent news to imply the development of intelligent life in the galaxy. Scientists have found a potential habitable planet called "Proxima b" around the star Proxima Centauri, approximately 4.2 light years from the Sun.

It receives comparable amounts of energy to that the Earth gets from the Sun. If there is liquid form on the planet, it could harbour life, but researchers said there is still much to be done before that can be confirmed, such as checking for the atmosphere and chemicals that could support life.

