Physics for Pedestrians

Young India Fellowship [Term 1]

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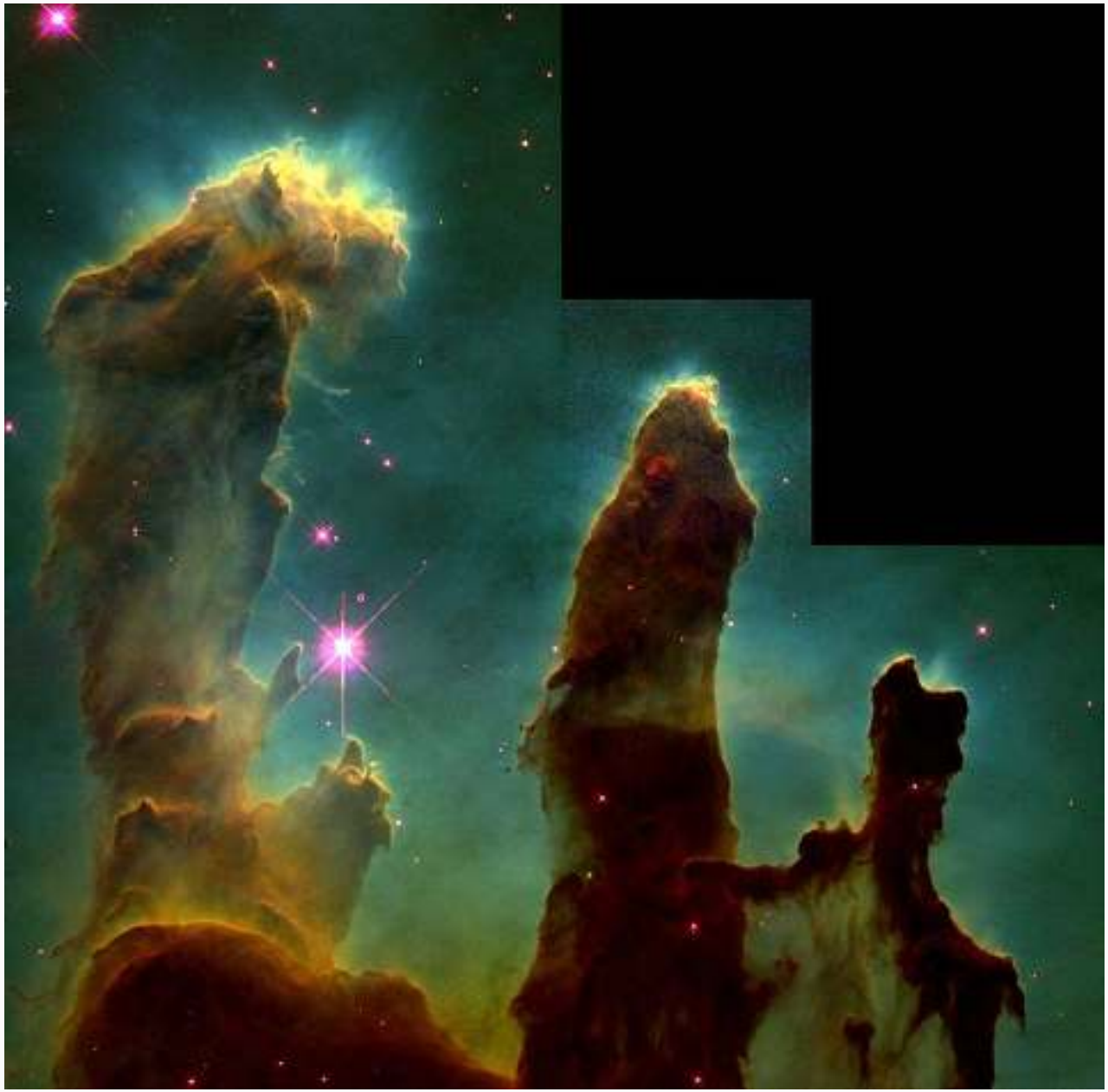
14th August, 2019

Ashoka University

The Big Bang

The Pillars of Creation



The Pillars of Creation

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An Expanding Universe?

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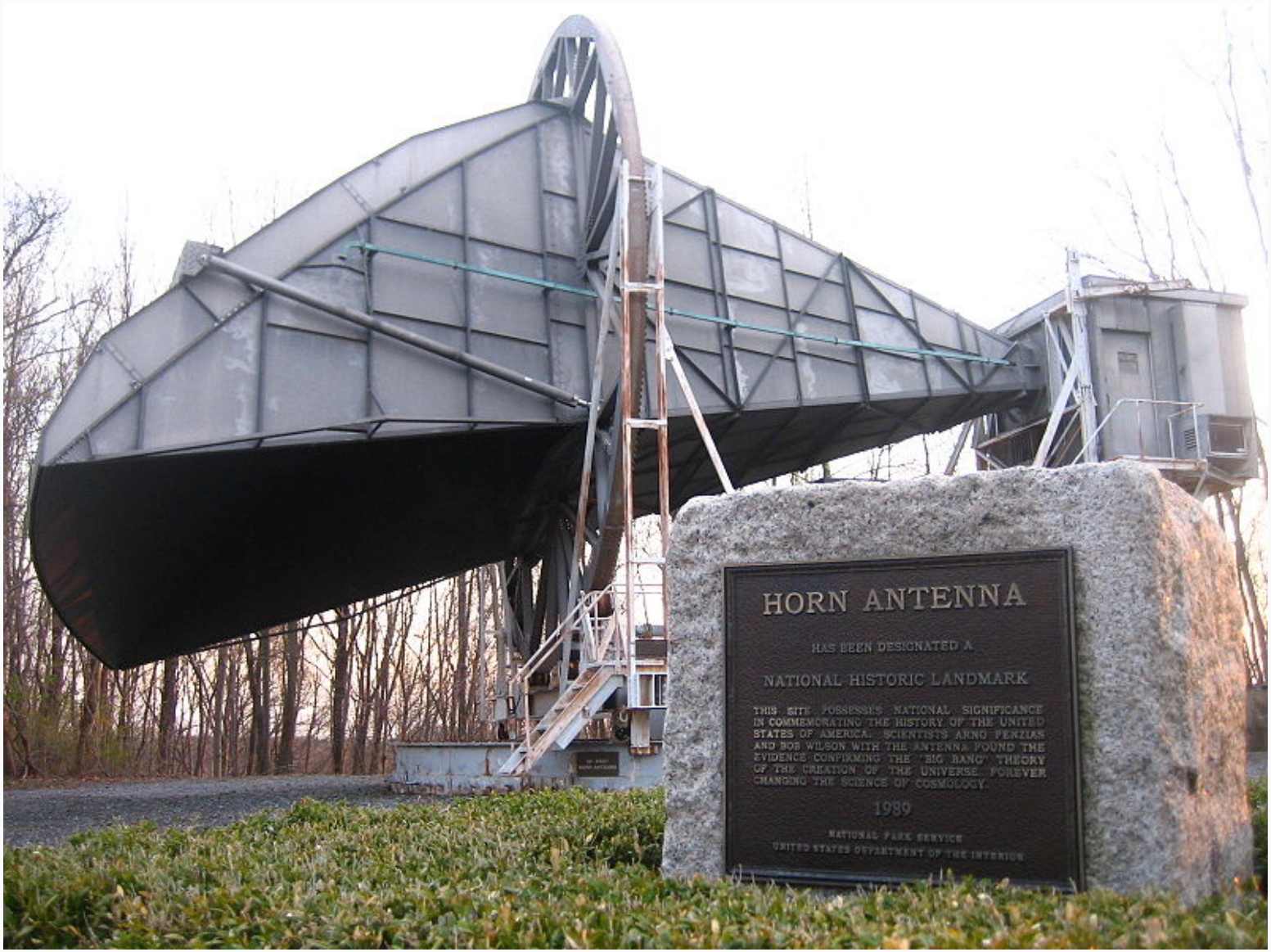
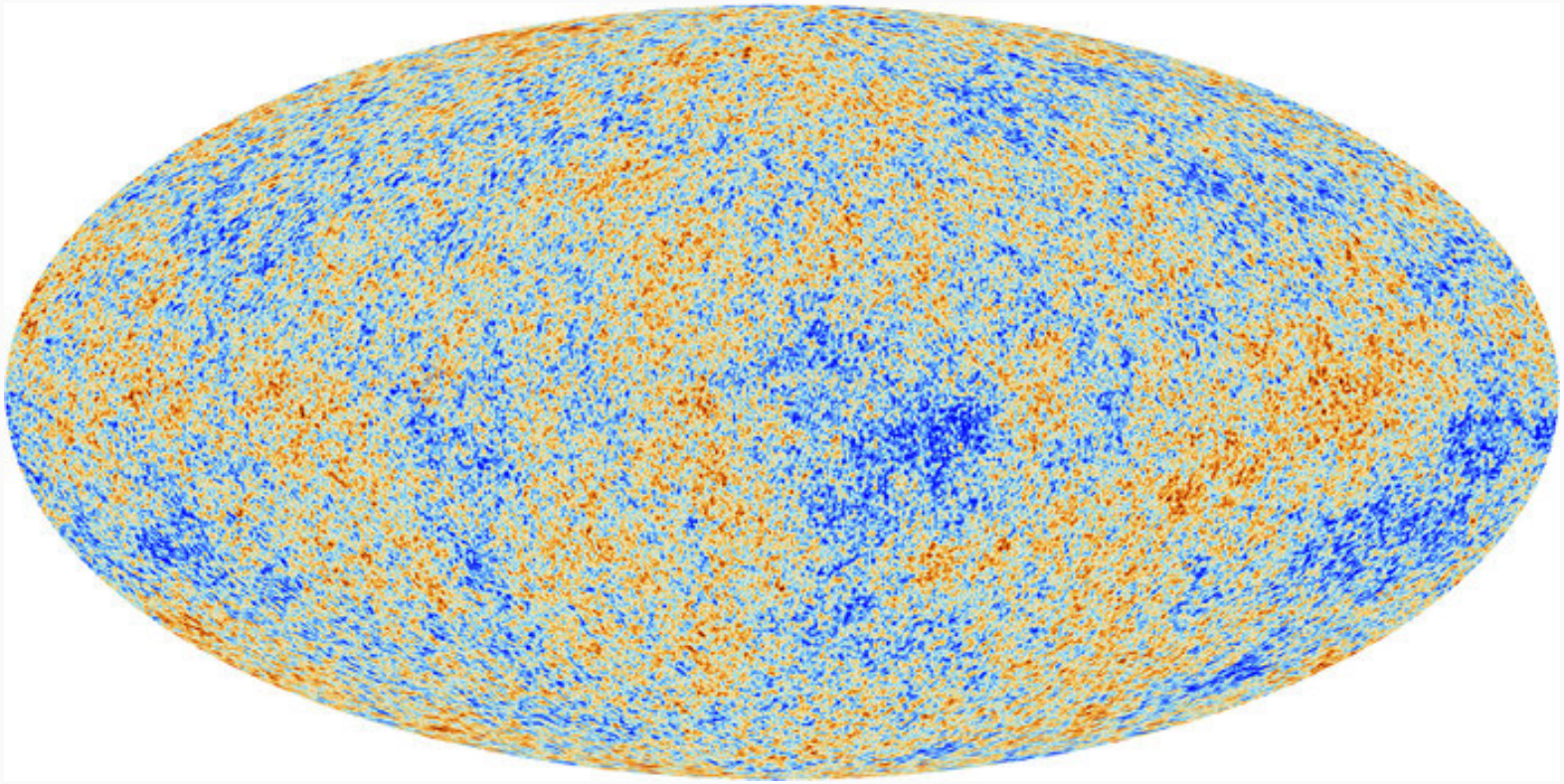


The Cosmic Microwave Background Radiation



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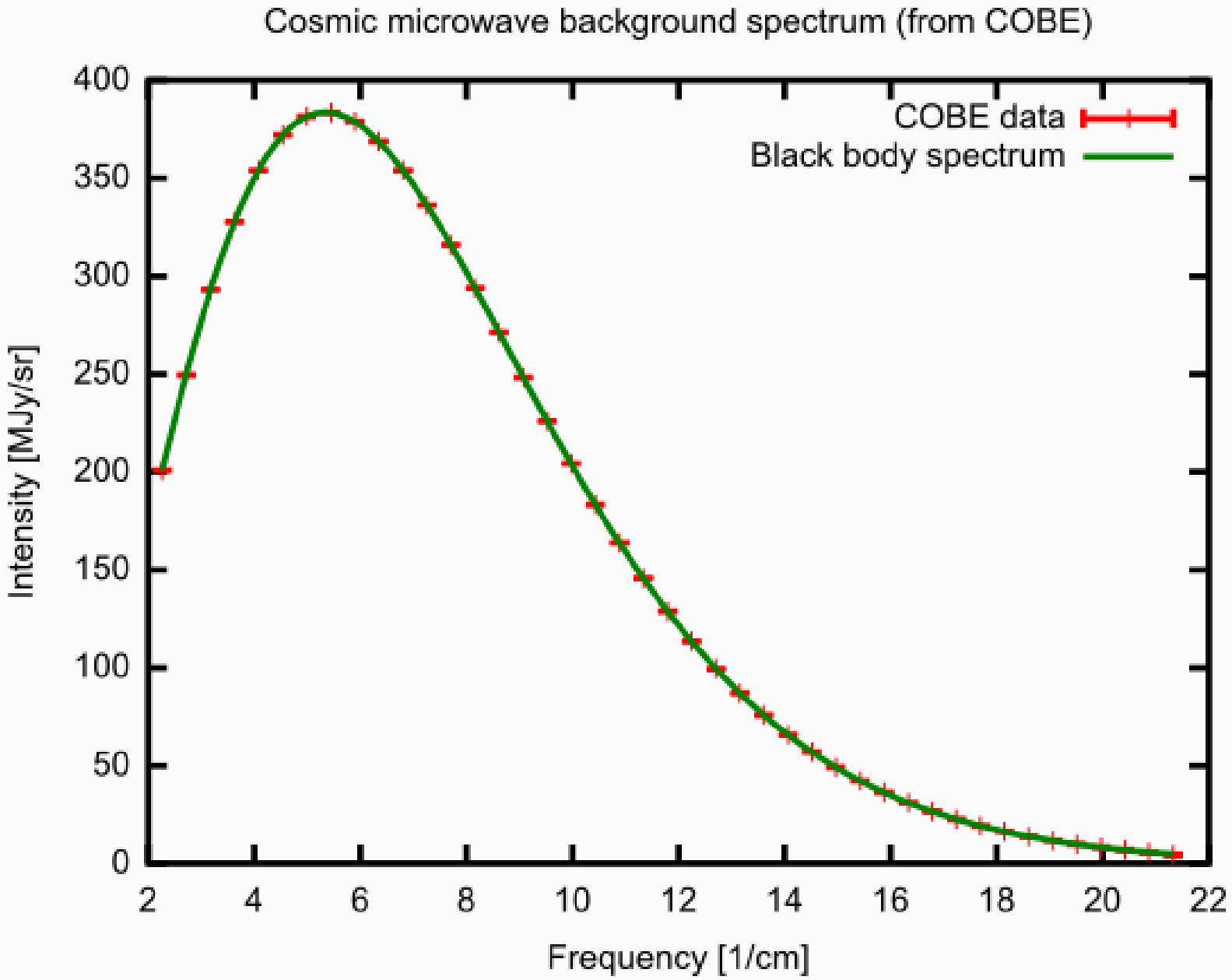
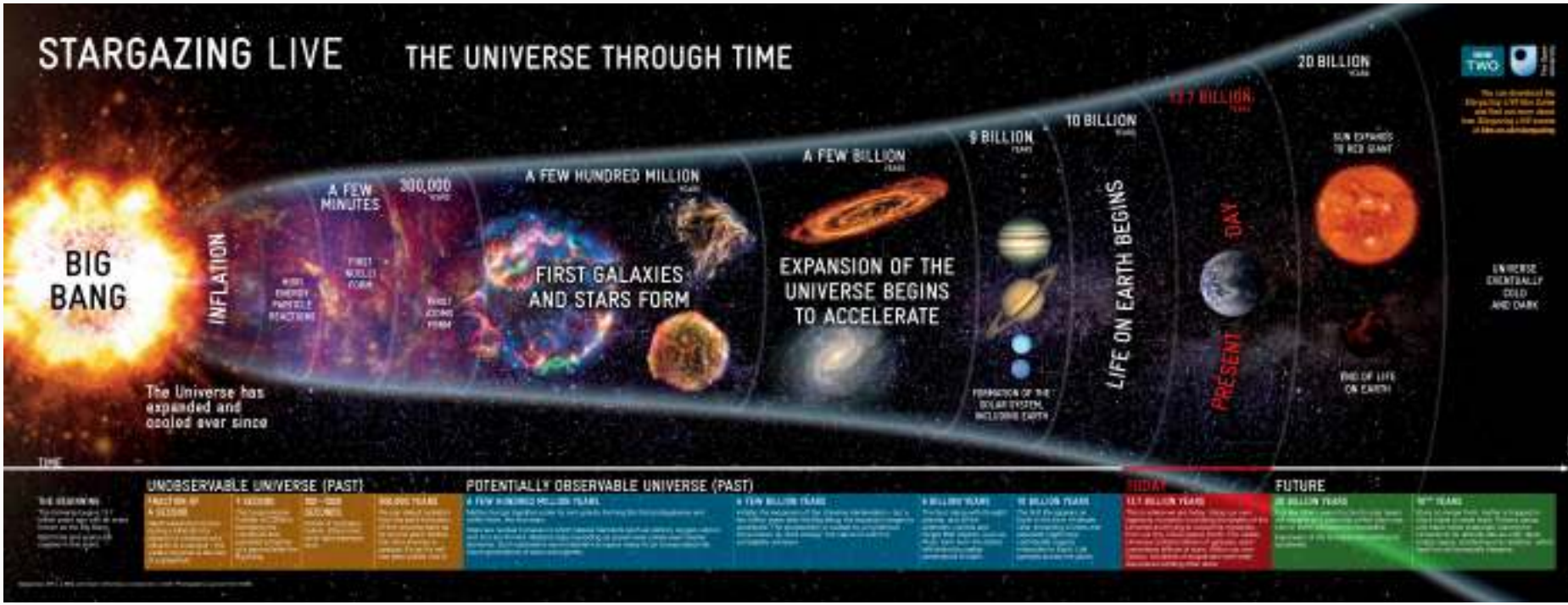
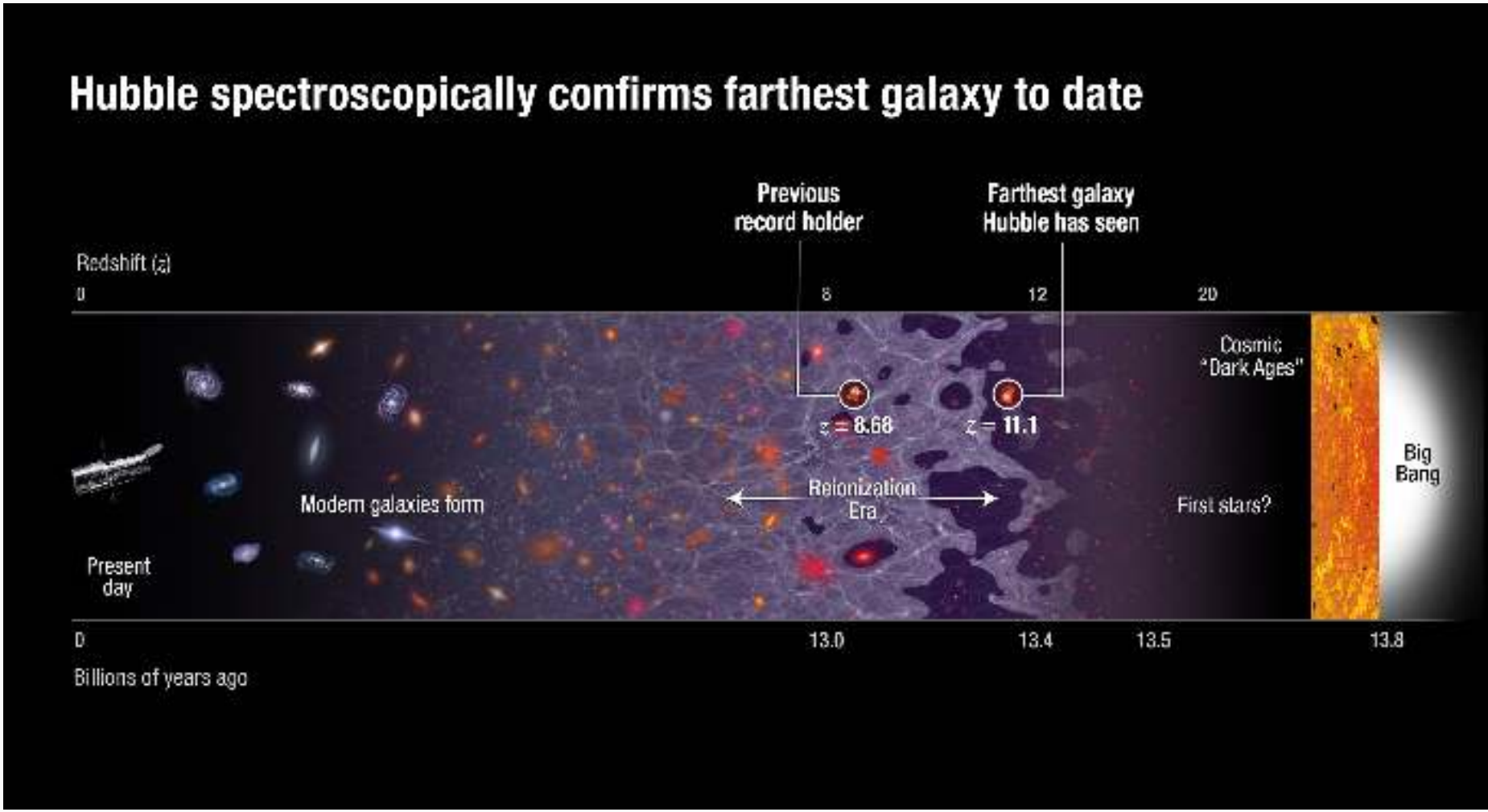


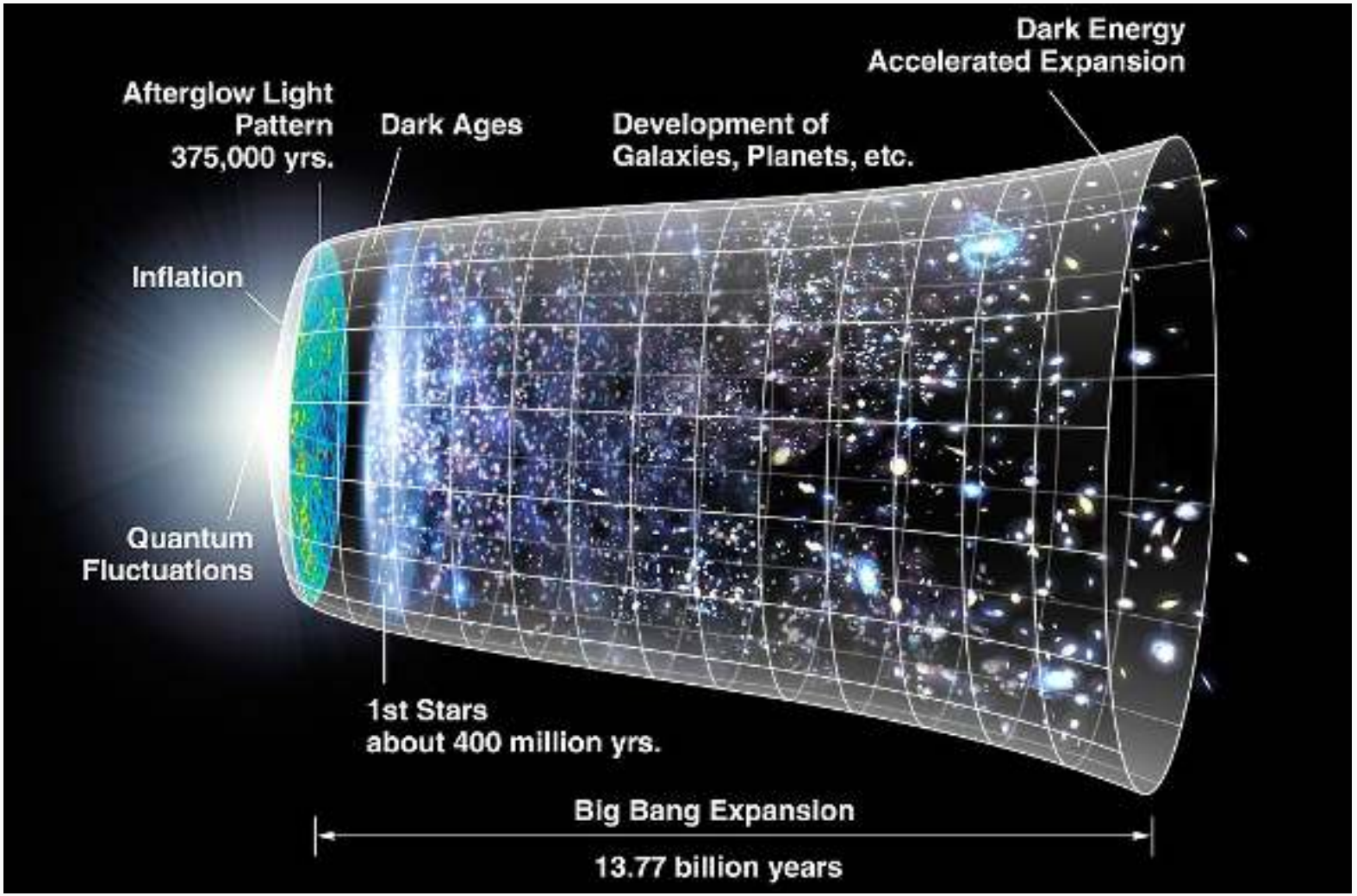
An Expanding Universe?



An Expanding Universe



An (Inflated) Expanding Universe



Quiz 4!

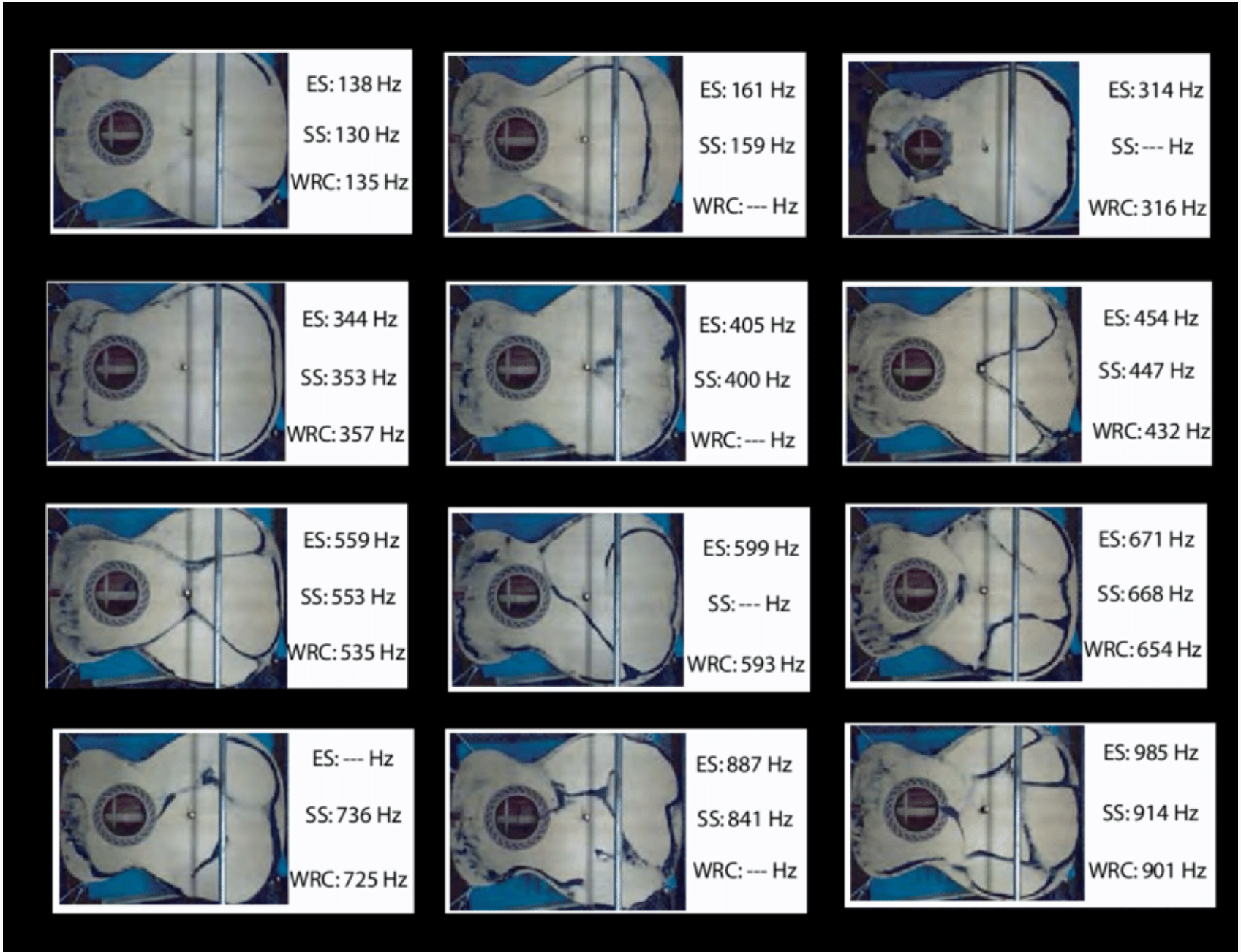
Link:

http://tiny.cc/PedPhy4

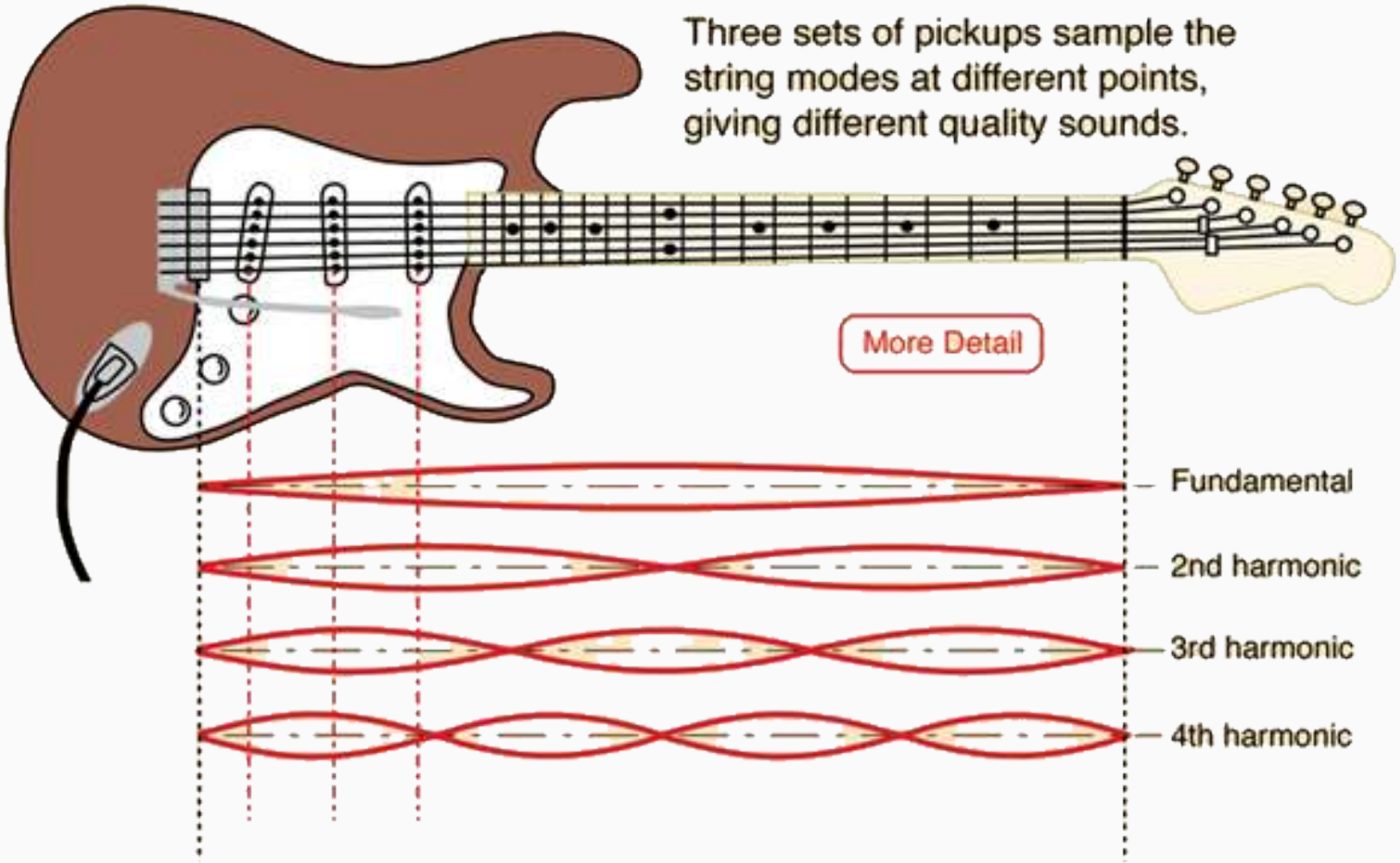
The Physics of a Guitar

Vibrating Strings

Chladni Patterns on Guitars



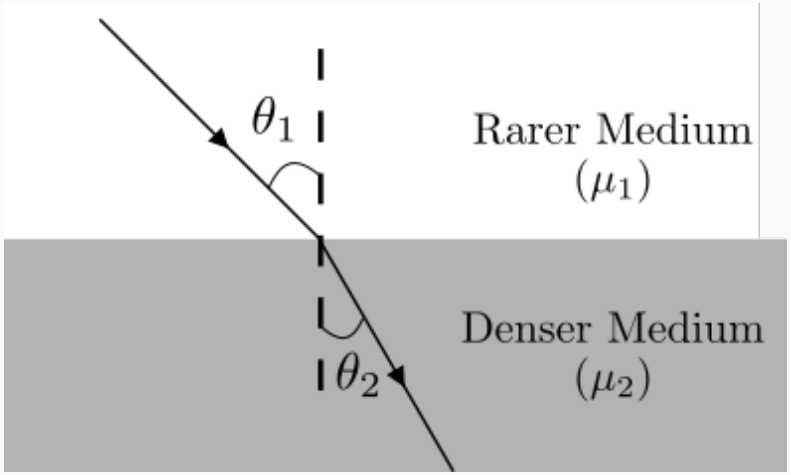
Placing a pickup on an electric guitar



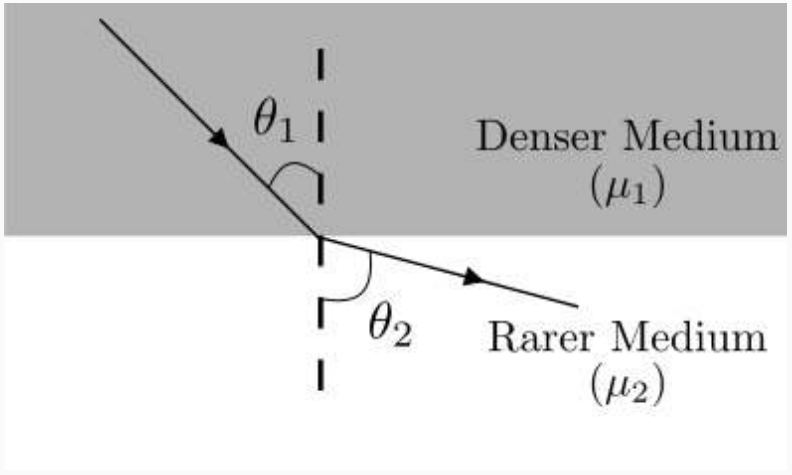
Unweaving the Rainbow

Double Rainbow

Refraction of Light



(a) $\mu_1 < \mu_2$:
The refracted ray is deviated towards normal.



(b) $\mu_1 > \mu_2$:
The refracted ray is deviated away from normal.

Figure 1: The propagation of a ray of light between media of different refractive indices.

Dispersion within a drop

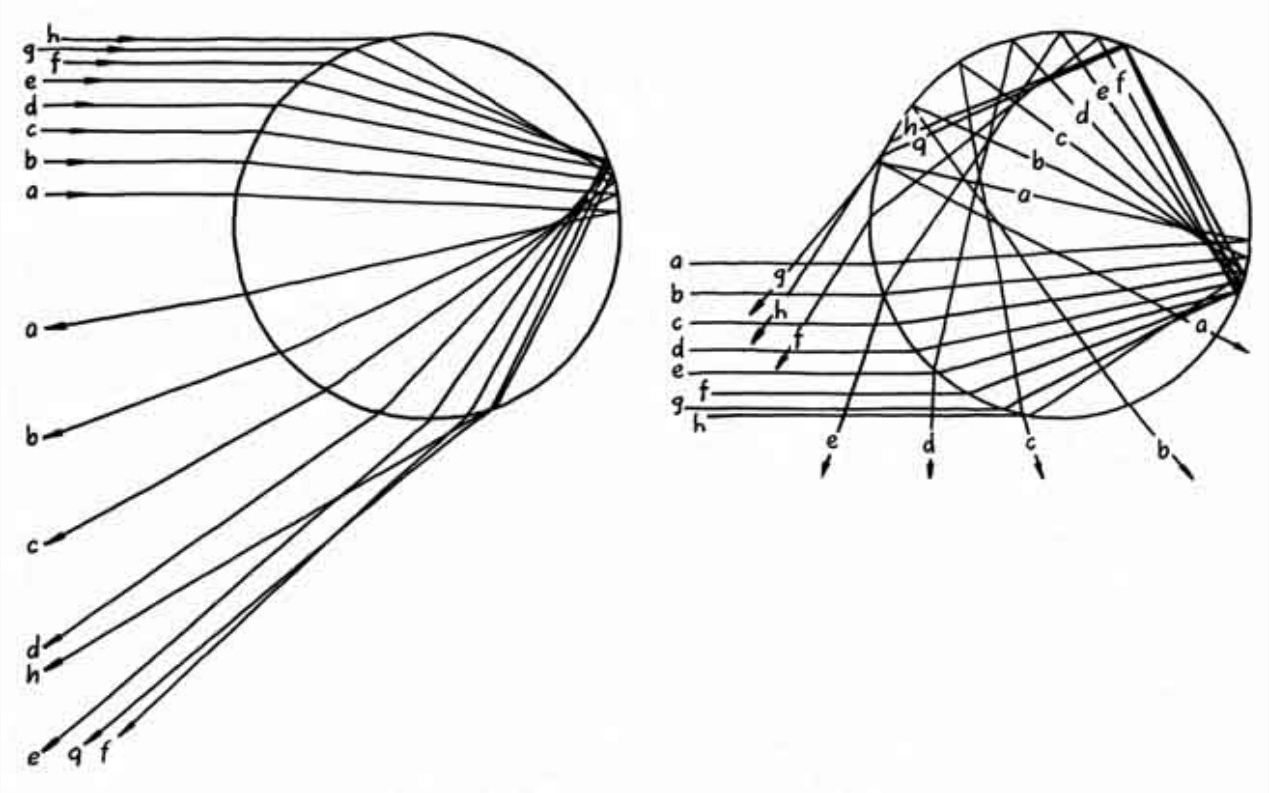


Figure 2: Ray paths forming a primary rainbow (*left*) and a secondary rainbow (*right*): The rays f and g in the primary rainbow and g and h in the secondary rainbow are 'bunched' together as they are close to the angle of minimum deviation.

The Primary Rainbow

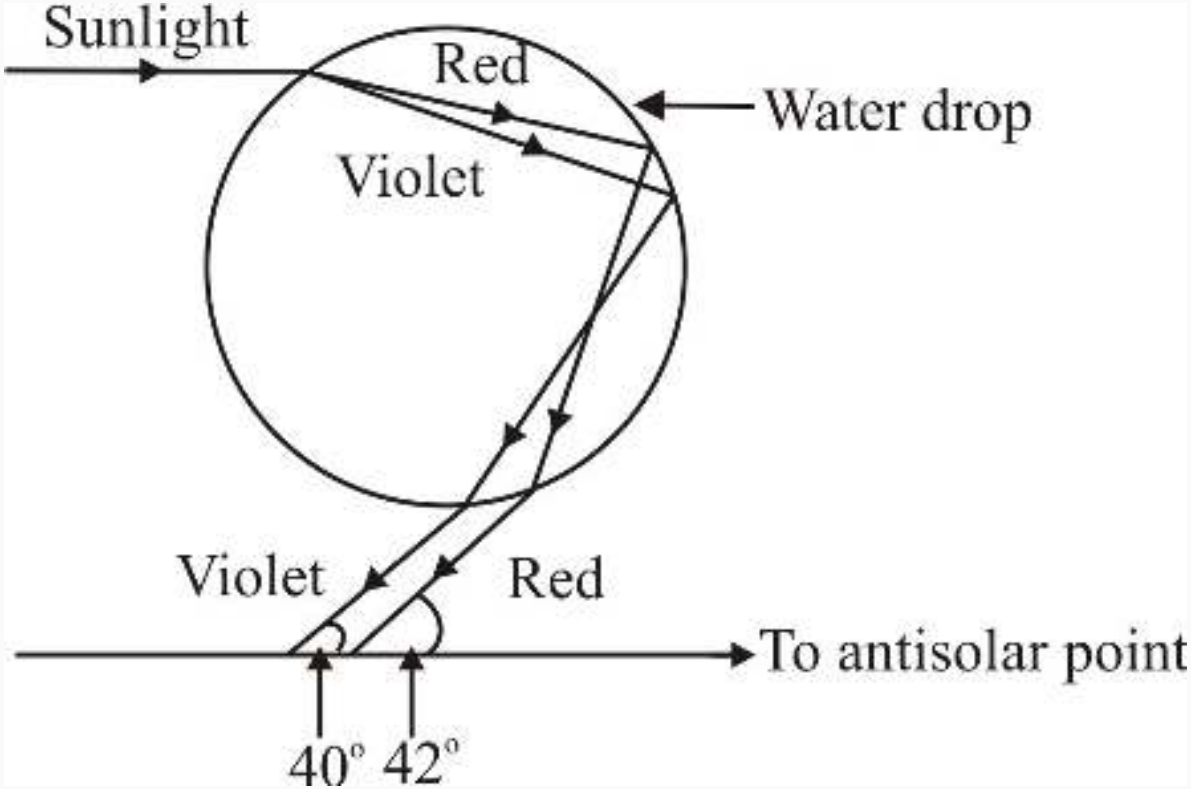


Figure 3: Ray diagram showing the dispersion of light within the droplet. The rainbow is thus seen roughly between 40° and 42° from the anti-solar point.

Minimum Deviation

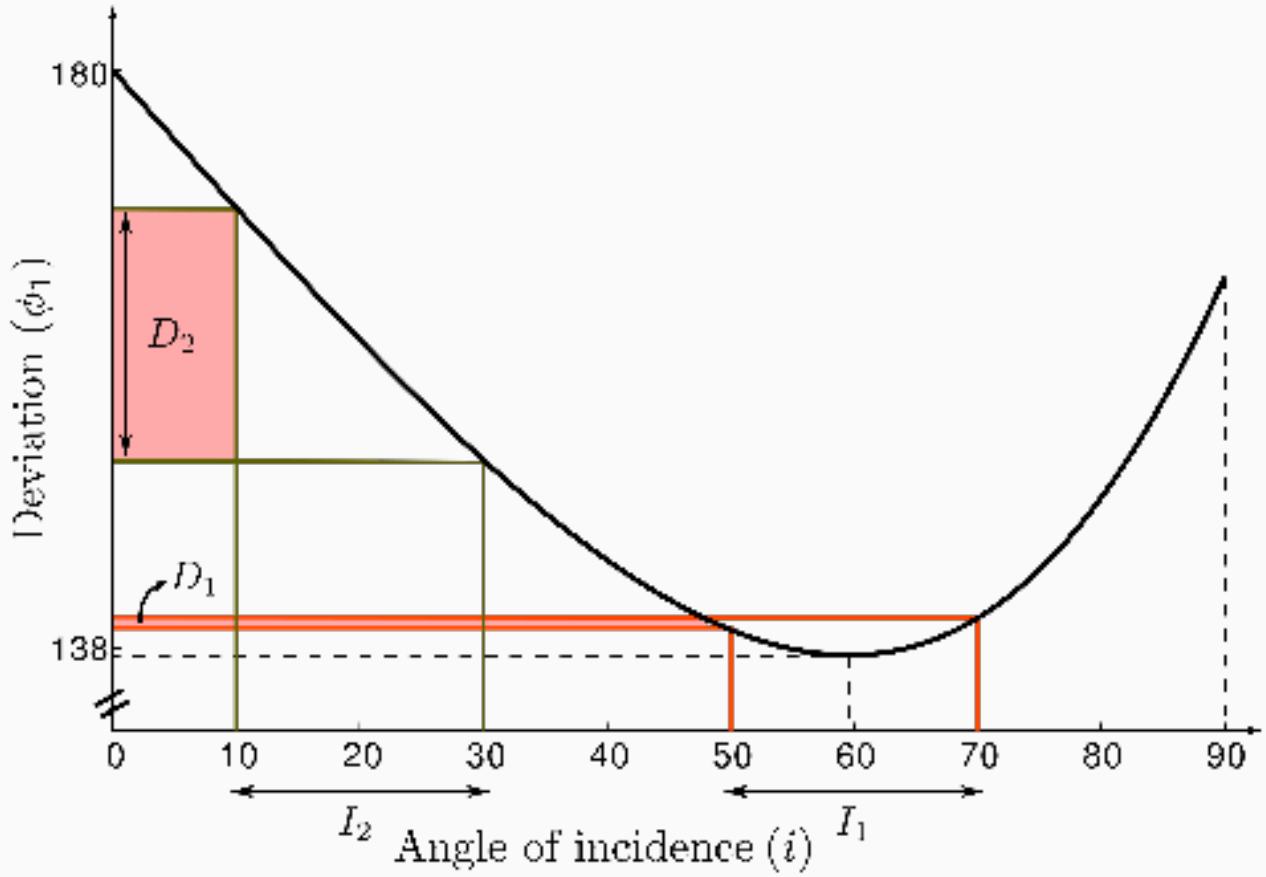


Figure 4: The angle of deviation approaches a minimum value of around 138° at $i = 59.4°$ ($r = 40.2°$ and $\varphi_1^{\max} = 42°$). The significance of this minimum is that rays from a range I_1 around the minimum "bunch" closer together than those from a range I_2 centred around some other point.

Positions of Rainbows in the Sky

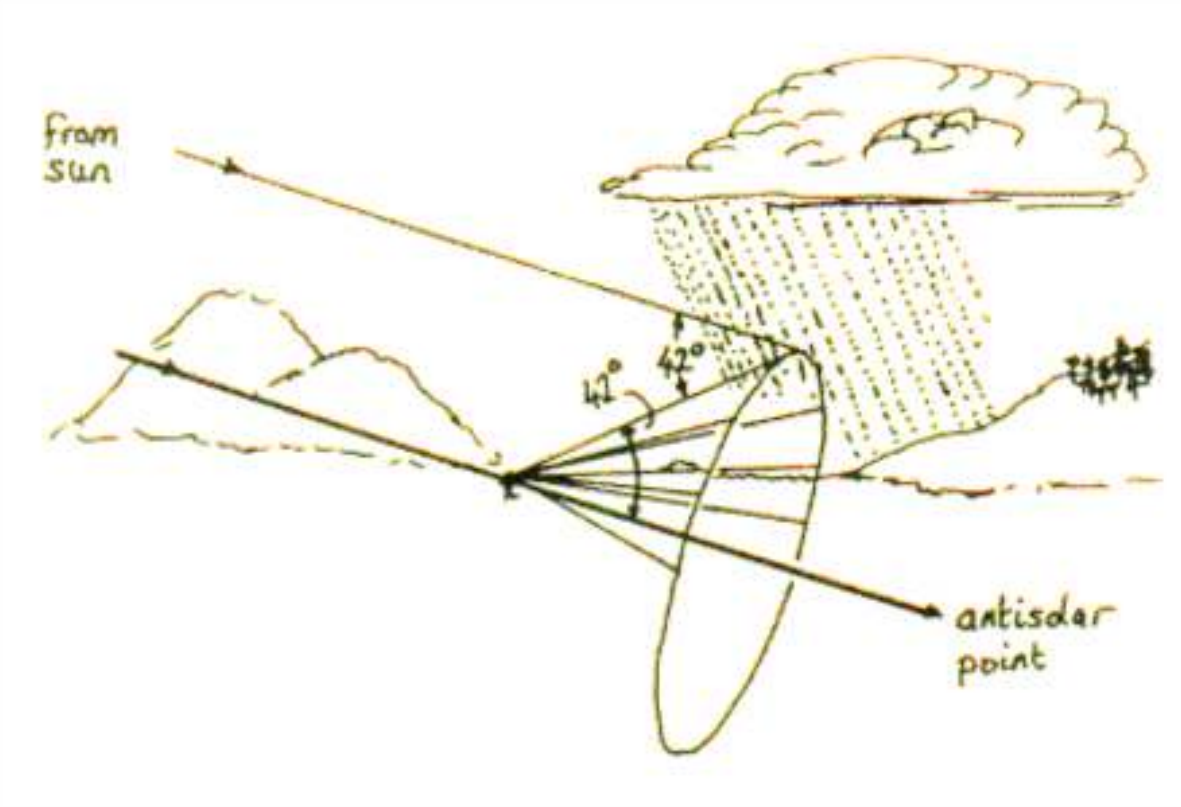
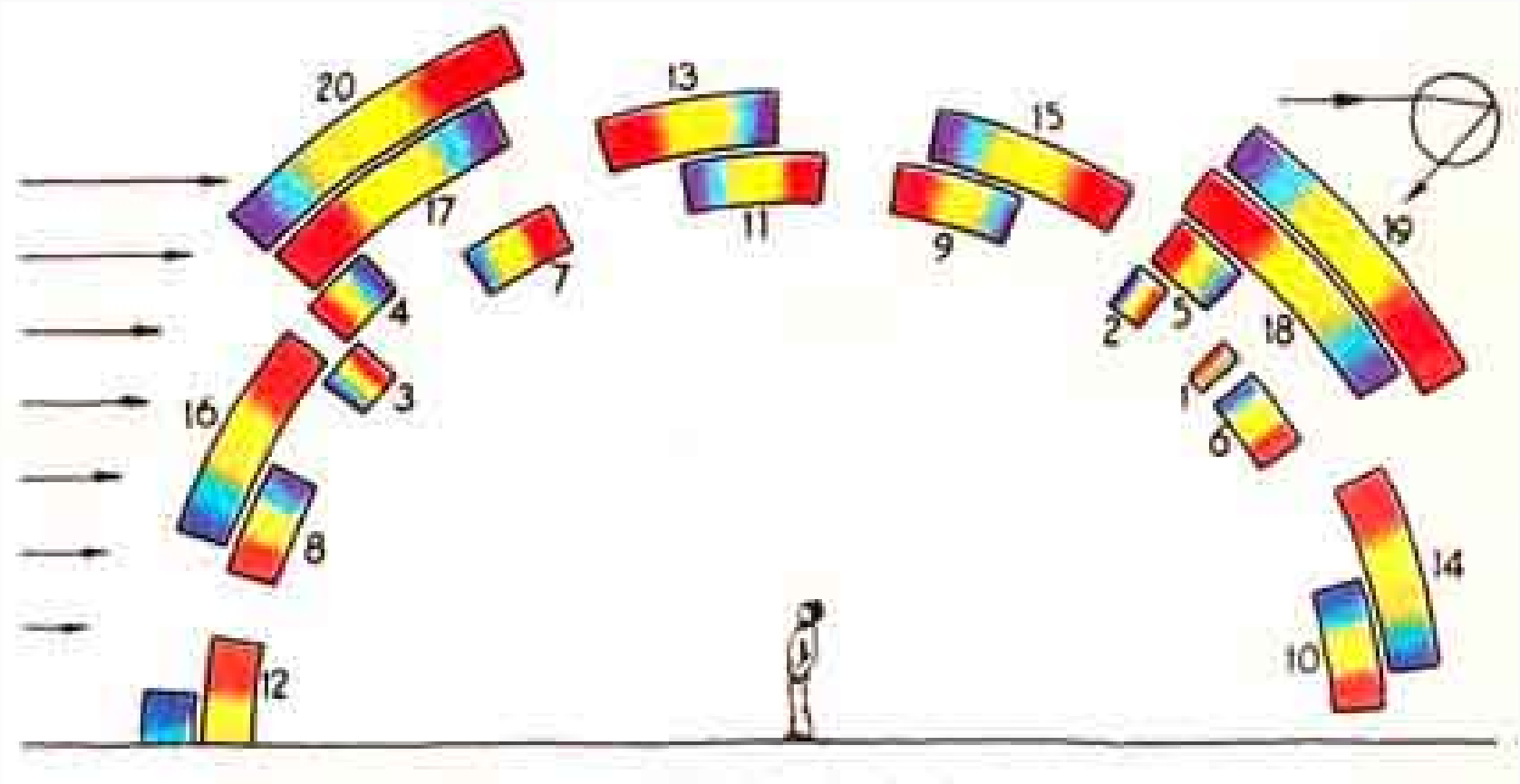


Figure 5: Angular position of the primary rainbow in the sky.

Multiple Rainbows in the Sky

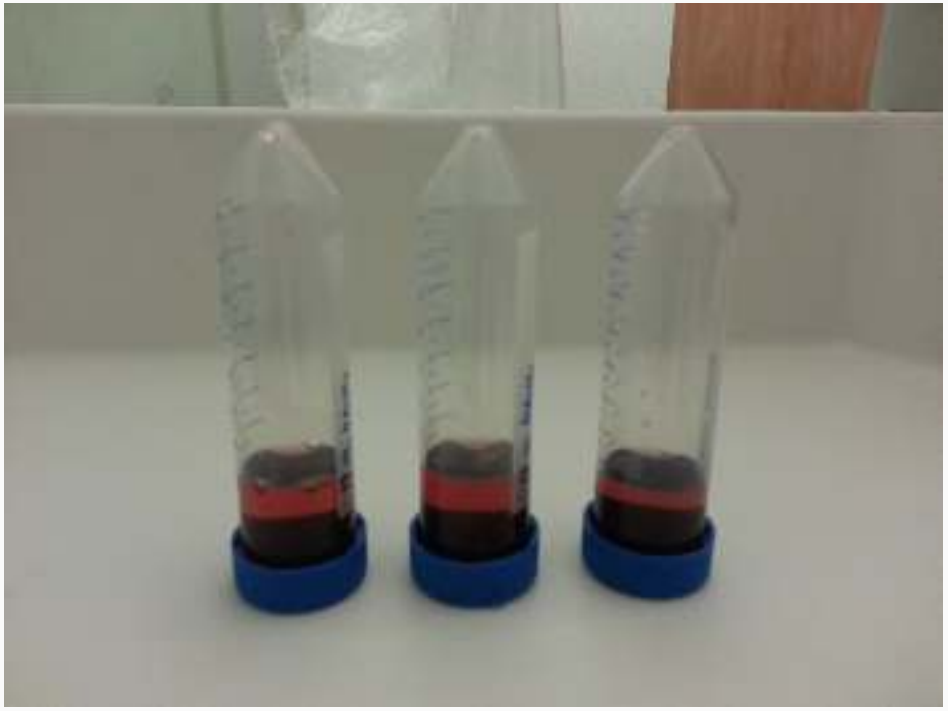


Rainbows of different refractive indices

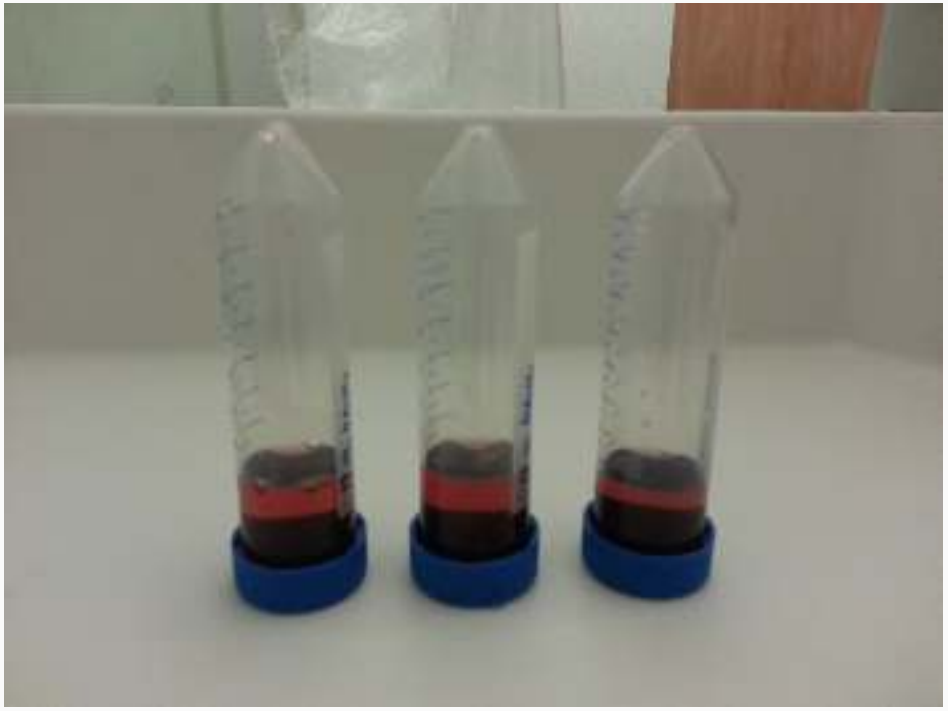
Figure 6: The rainbow in freshwater raindrops is extended below the horizon by a rainbow in seawater spray. The saltwater drops cause the radius of the sub-horizon rainbow to be 0.8° less than that of the freshwater rainbow.

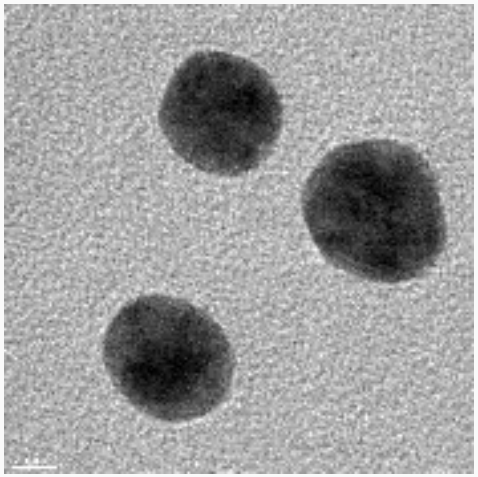
Stained Glass Windows

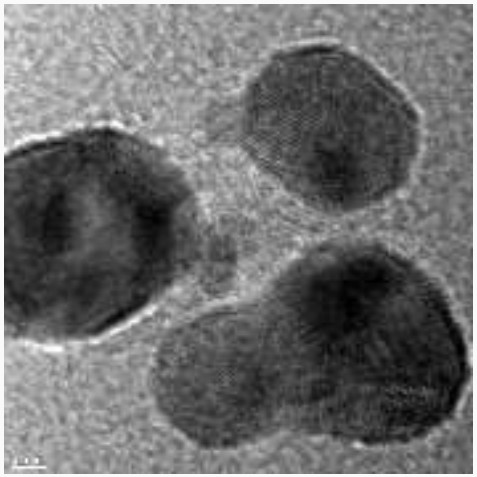
Nanoparticles of gold

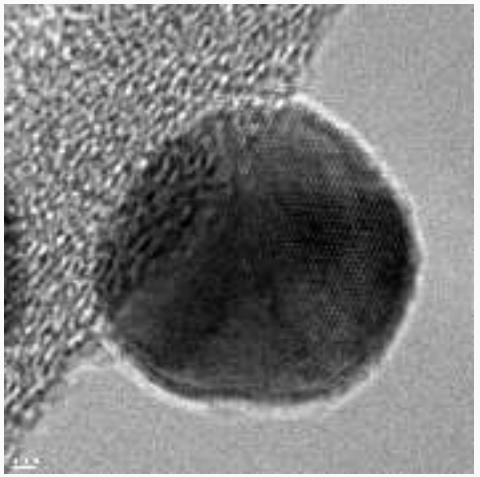


Nanoparticles of gold









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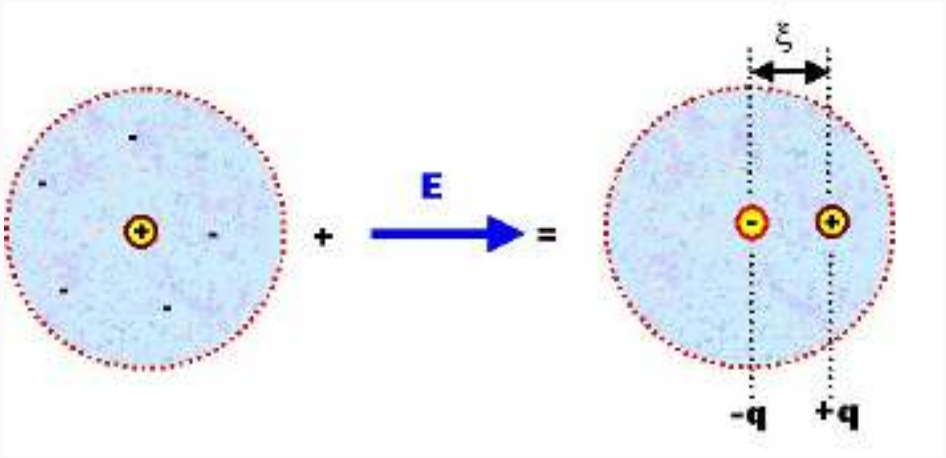

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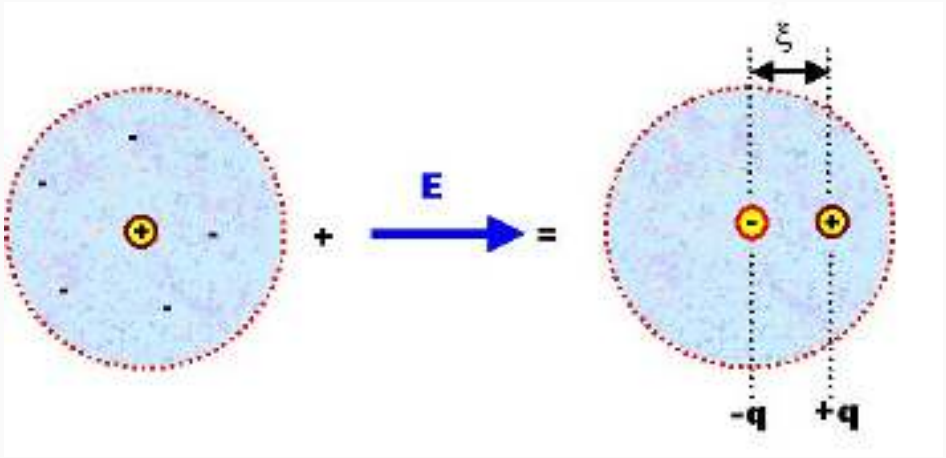

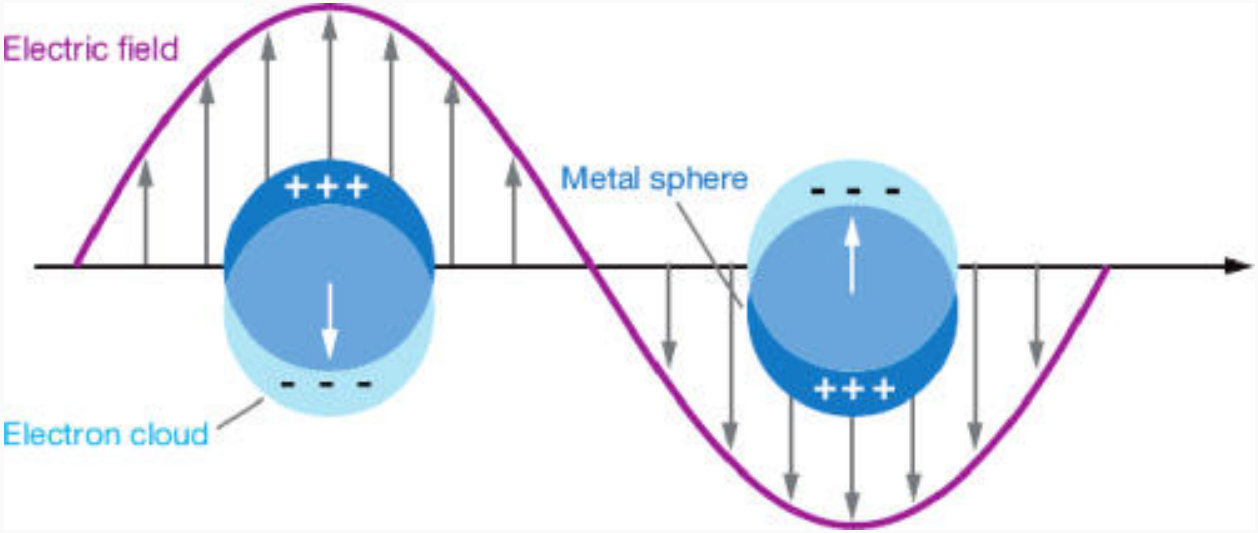

Absorbtion and Transmission of Light