

If only we dare.

It's because being American is more than a
pride we inherit,

it's the past we step into and how we repair it.

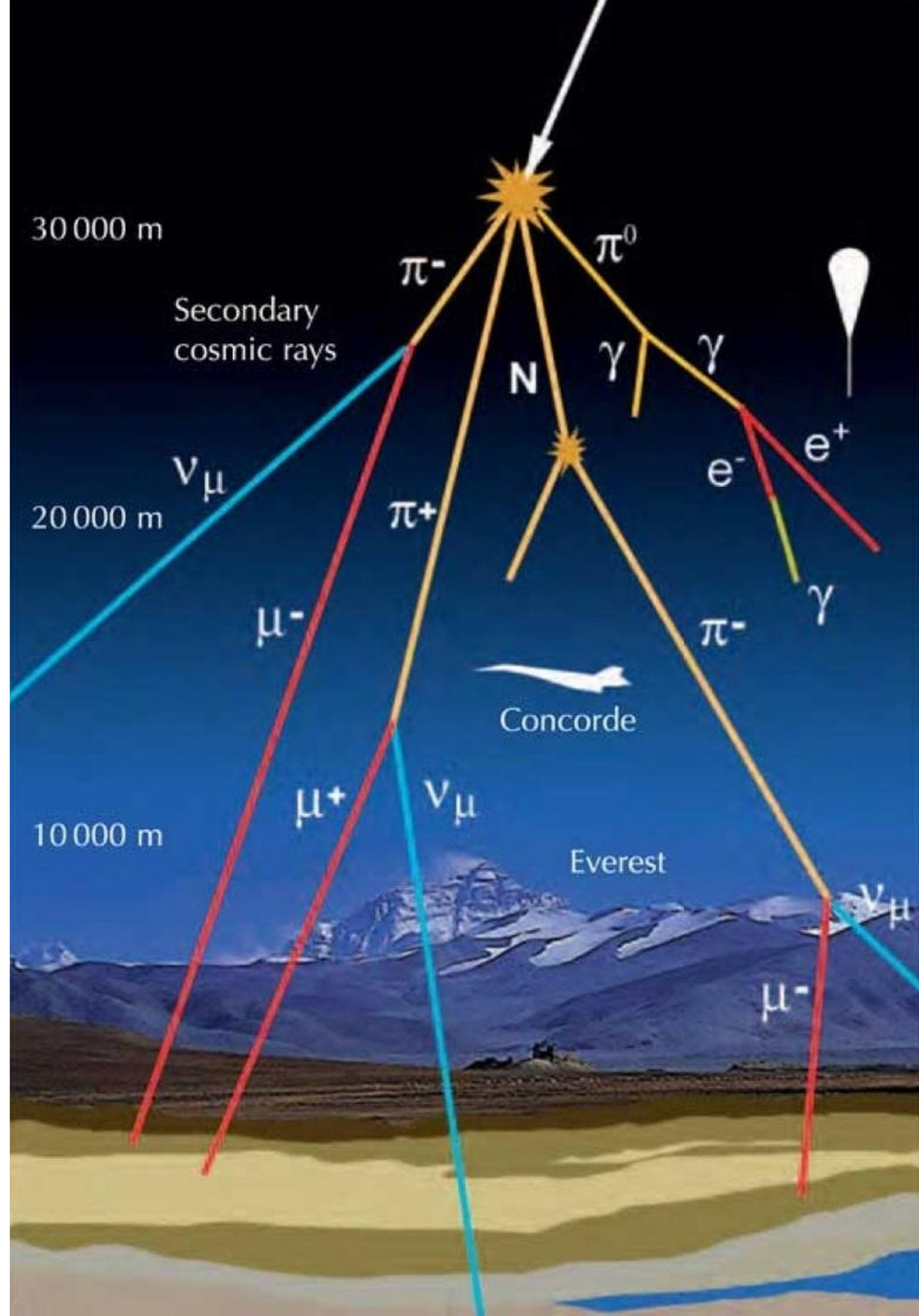
**– Amanda Gorman
The Hill We Climb**

Relativity

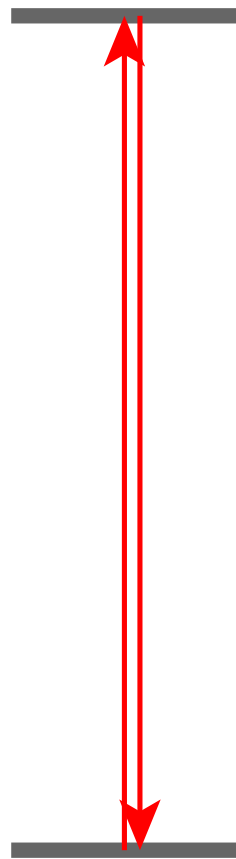
Conclusion

- Light travels through vacuum (like any particle)
- The speed of light is constant: ***all*** directions, ***all*** observers
- Time is not constant!

Atmospheric muons



Light clock



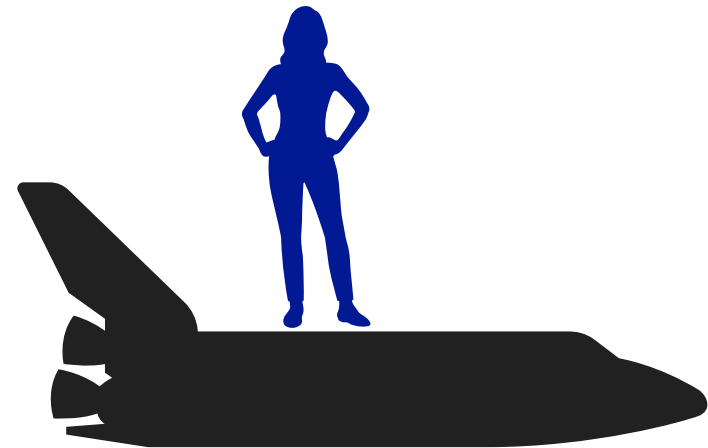
tick, tick, tick

Speed of light is ***constant***

Online course of the future

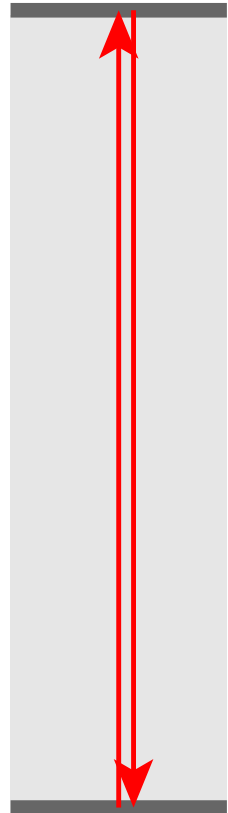


Student A

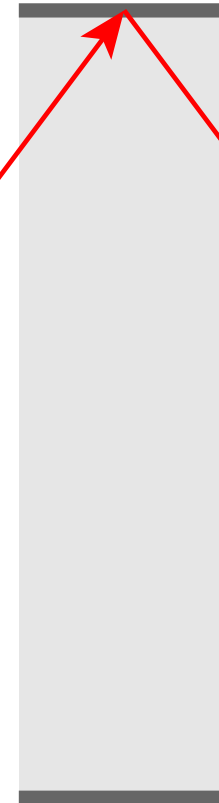
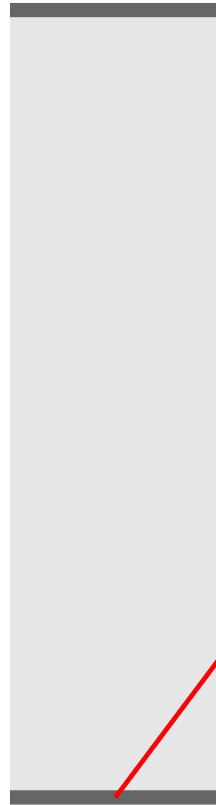


Student B

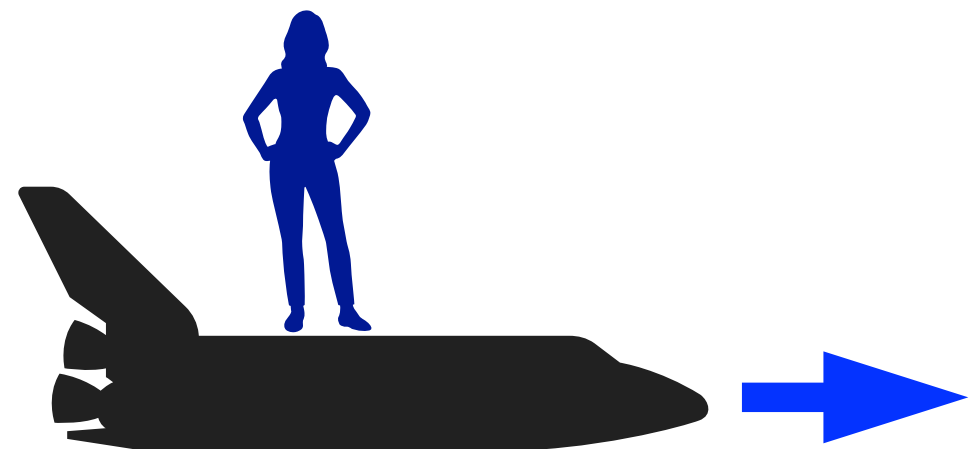
Light clock (student A homework)



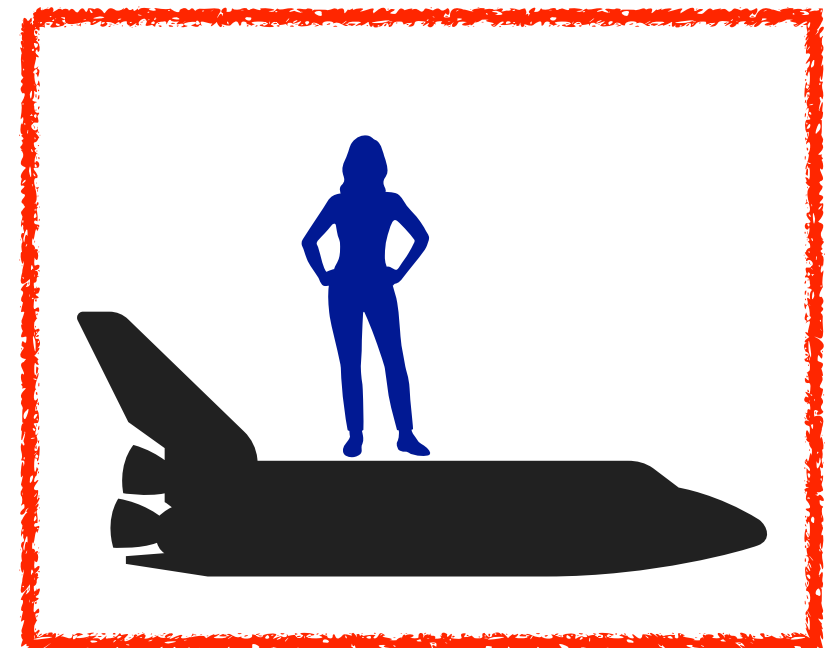
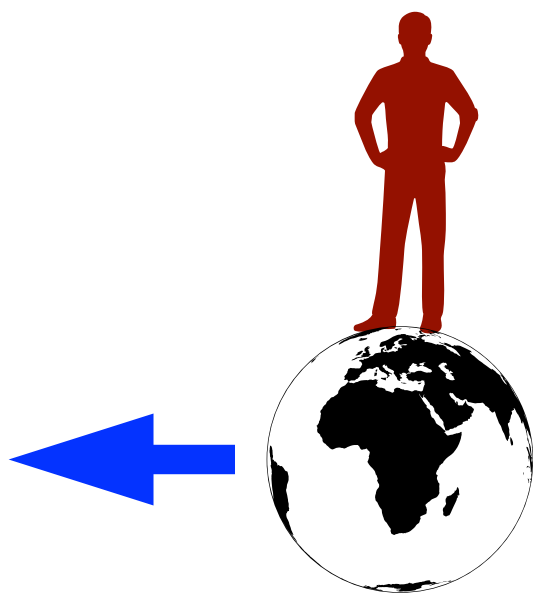
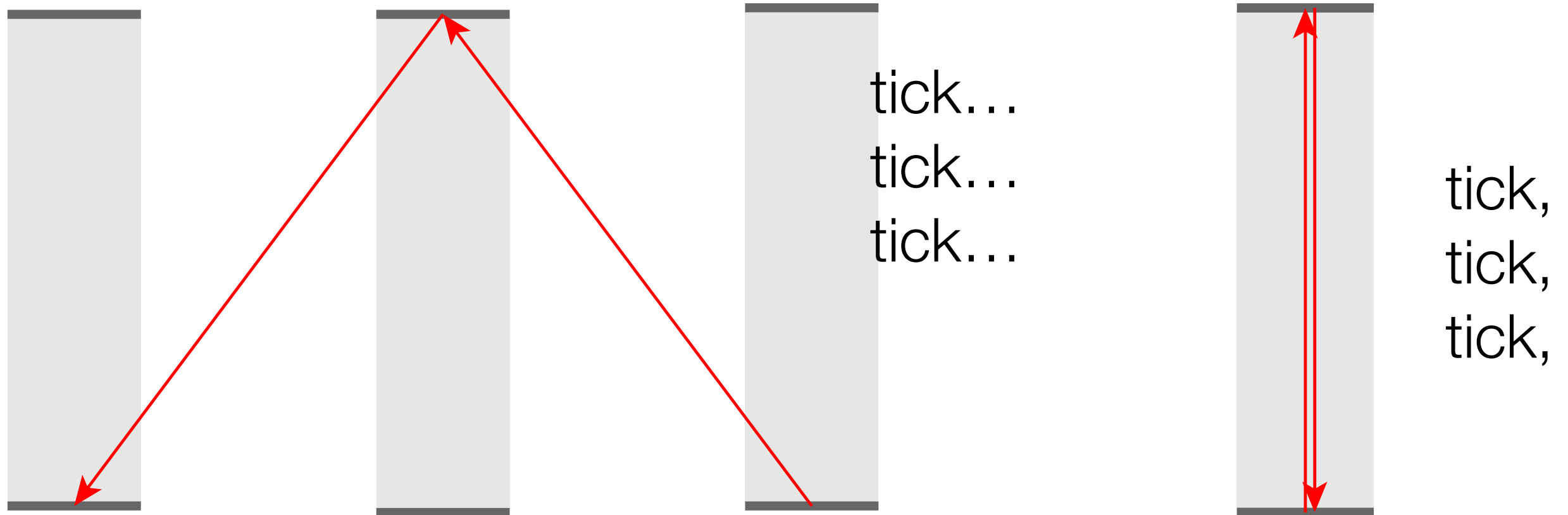
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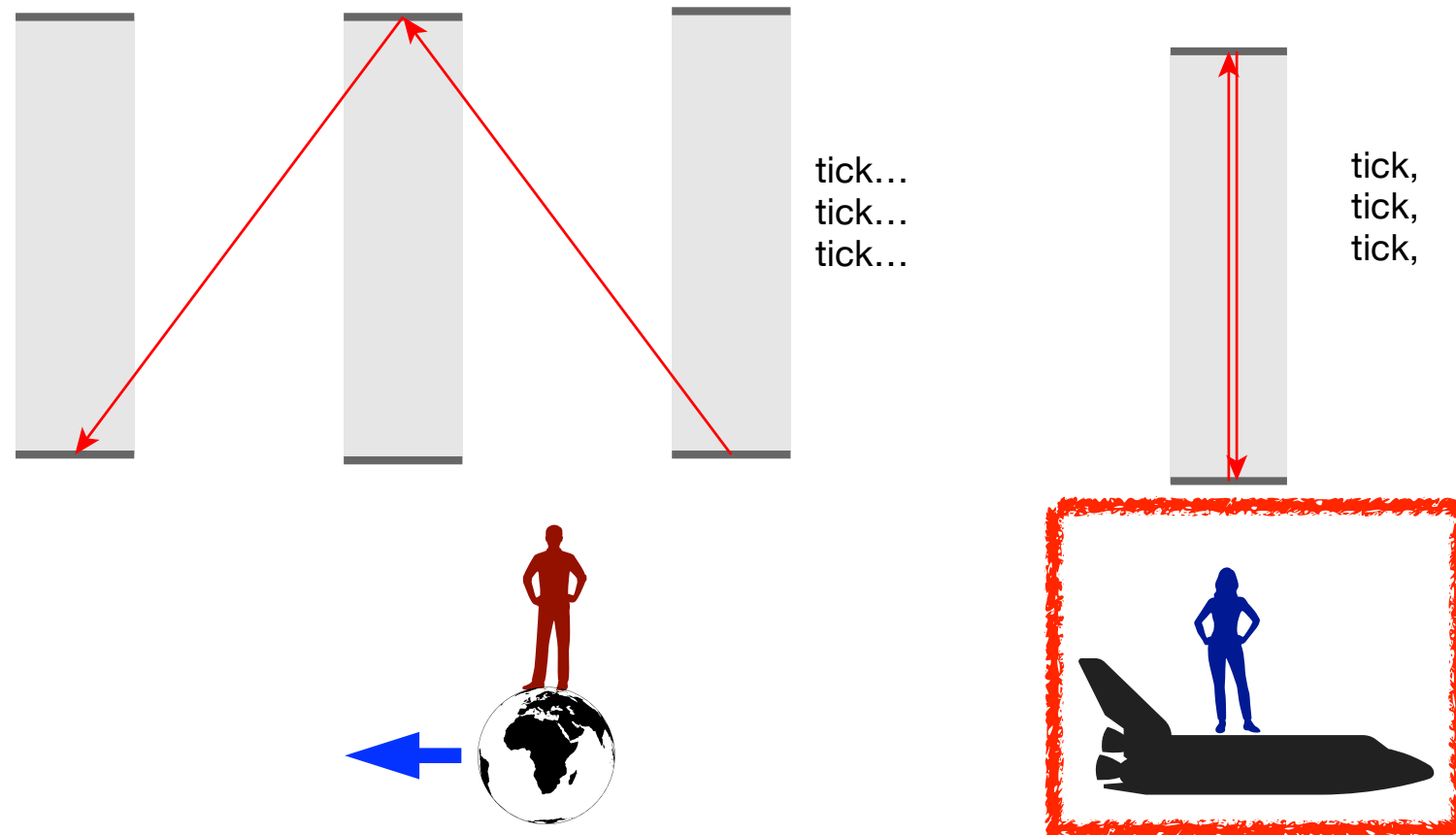
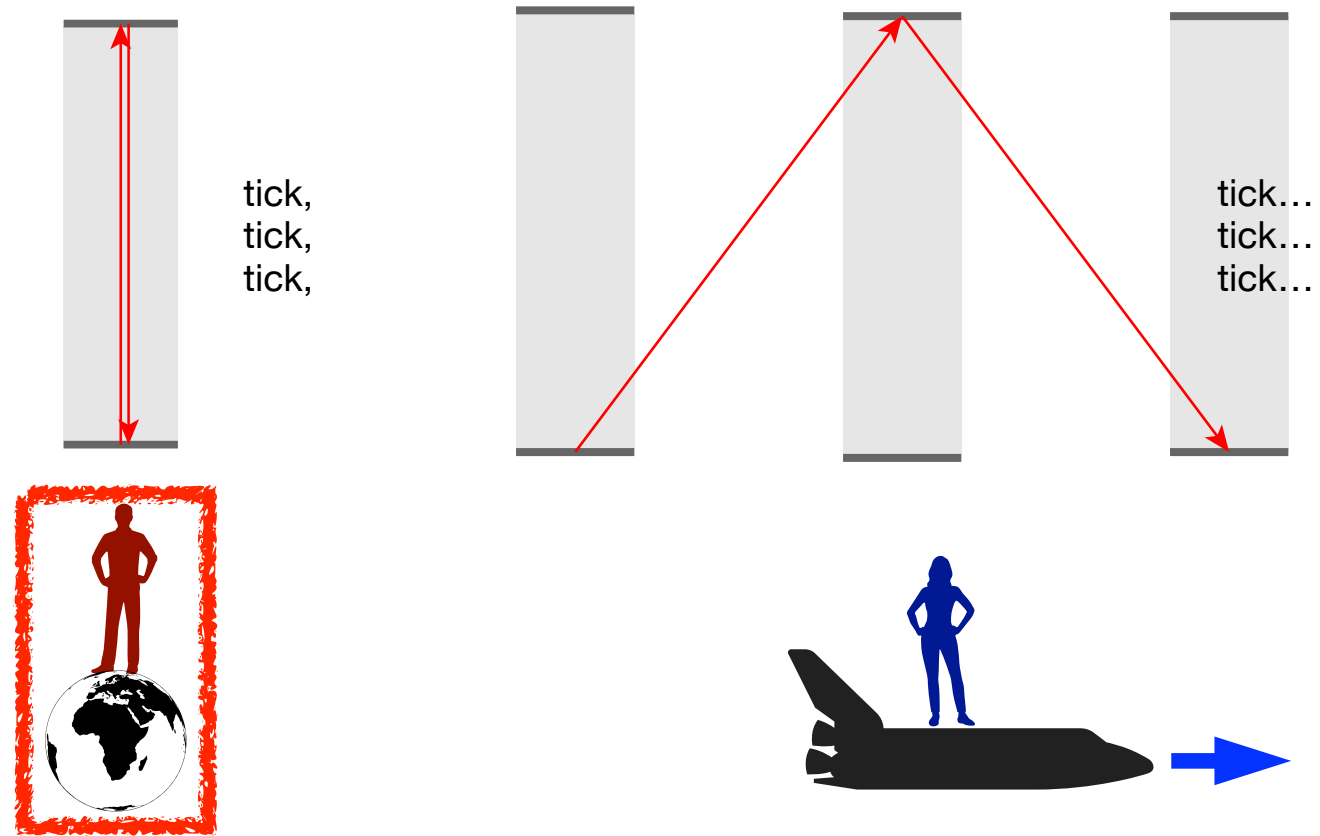


tick...
tick...
tick...



Light clock (student B homework)

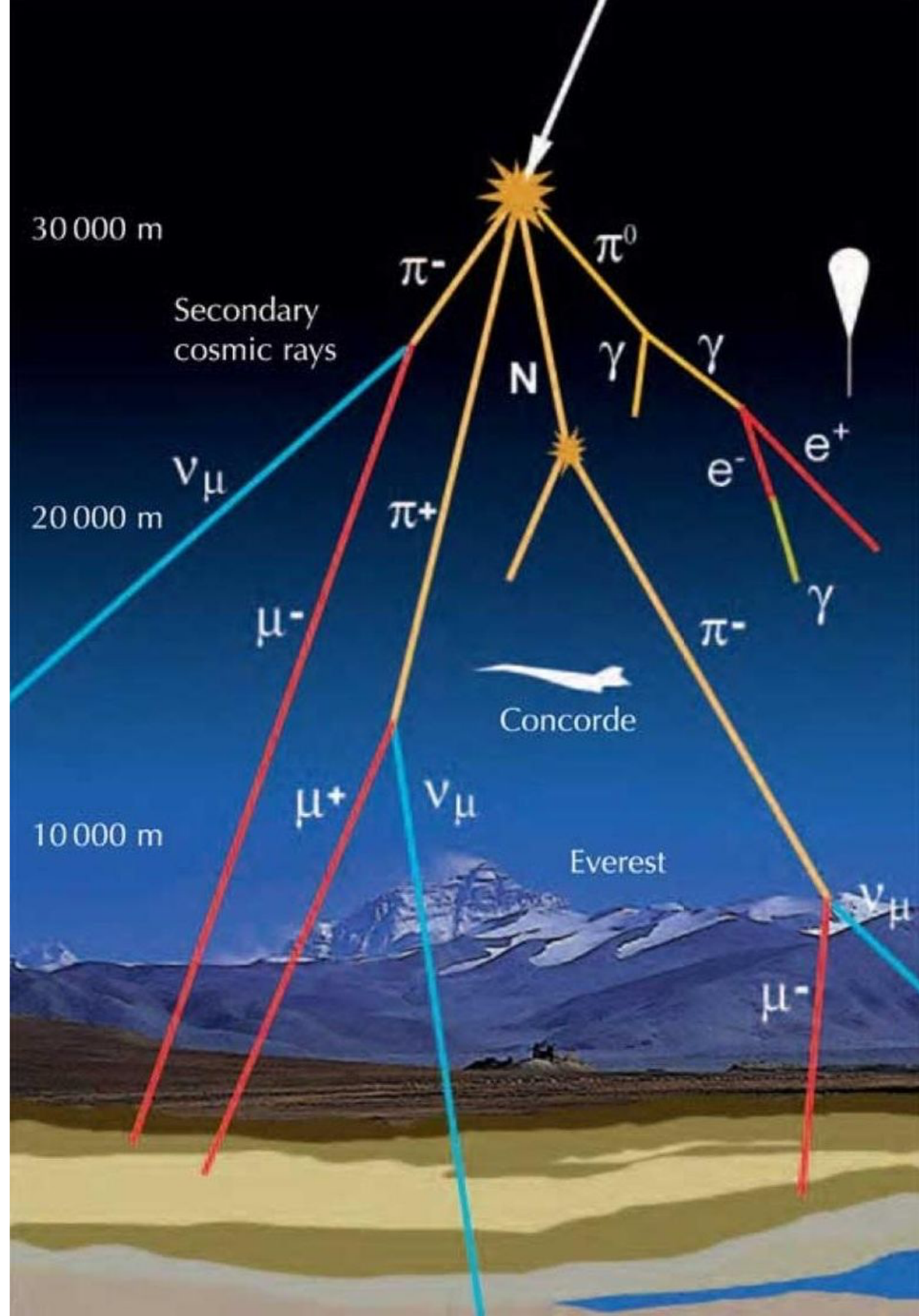




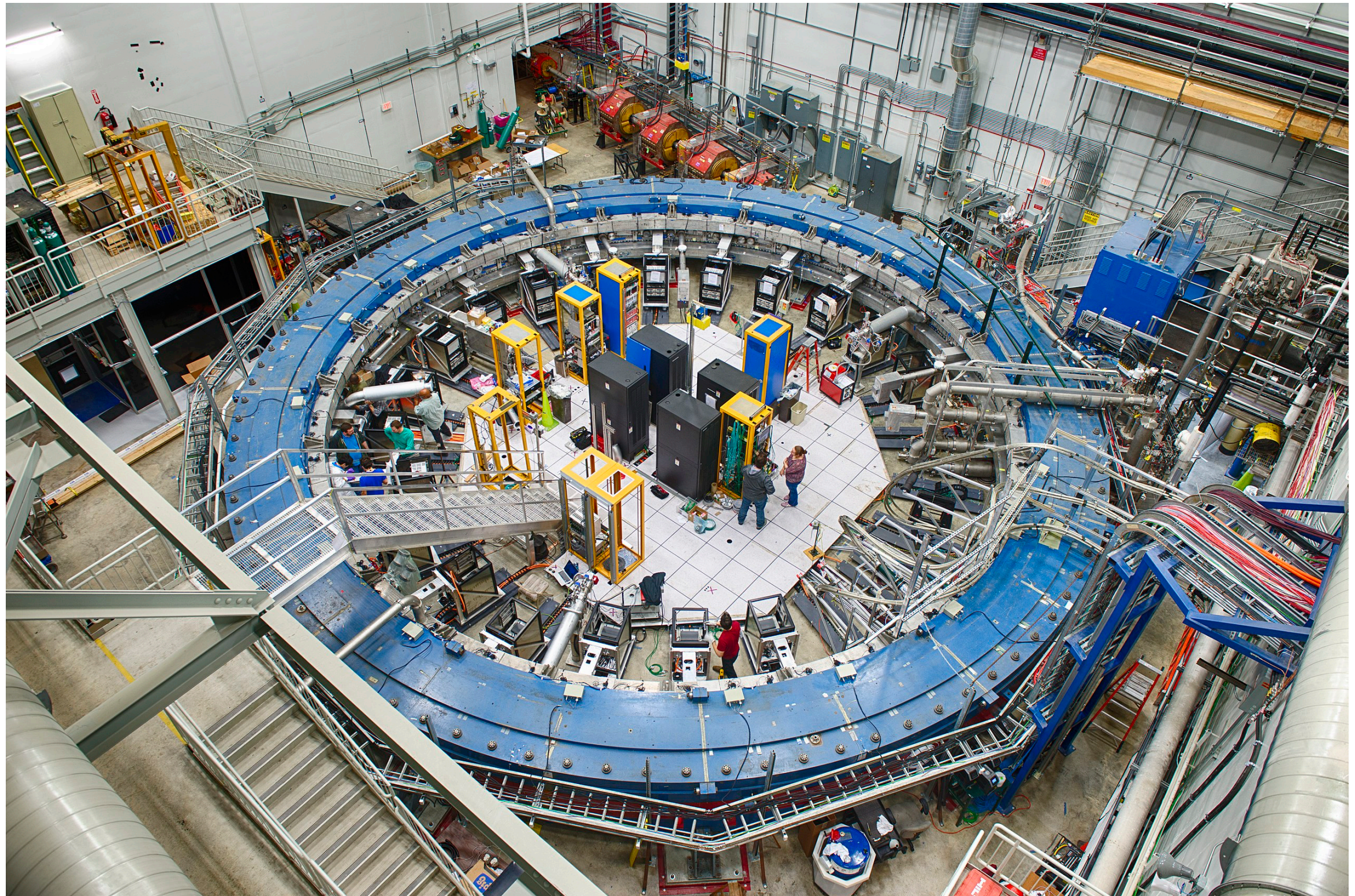
Takeaways

- Everyone see's their clock (time) as normal
- Everyone else's clock is running slow (if there is relative motion)
- They're **both** right

Atmospheric muons



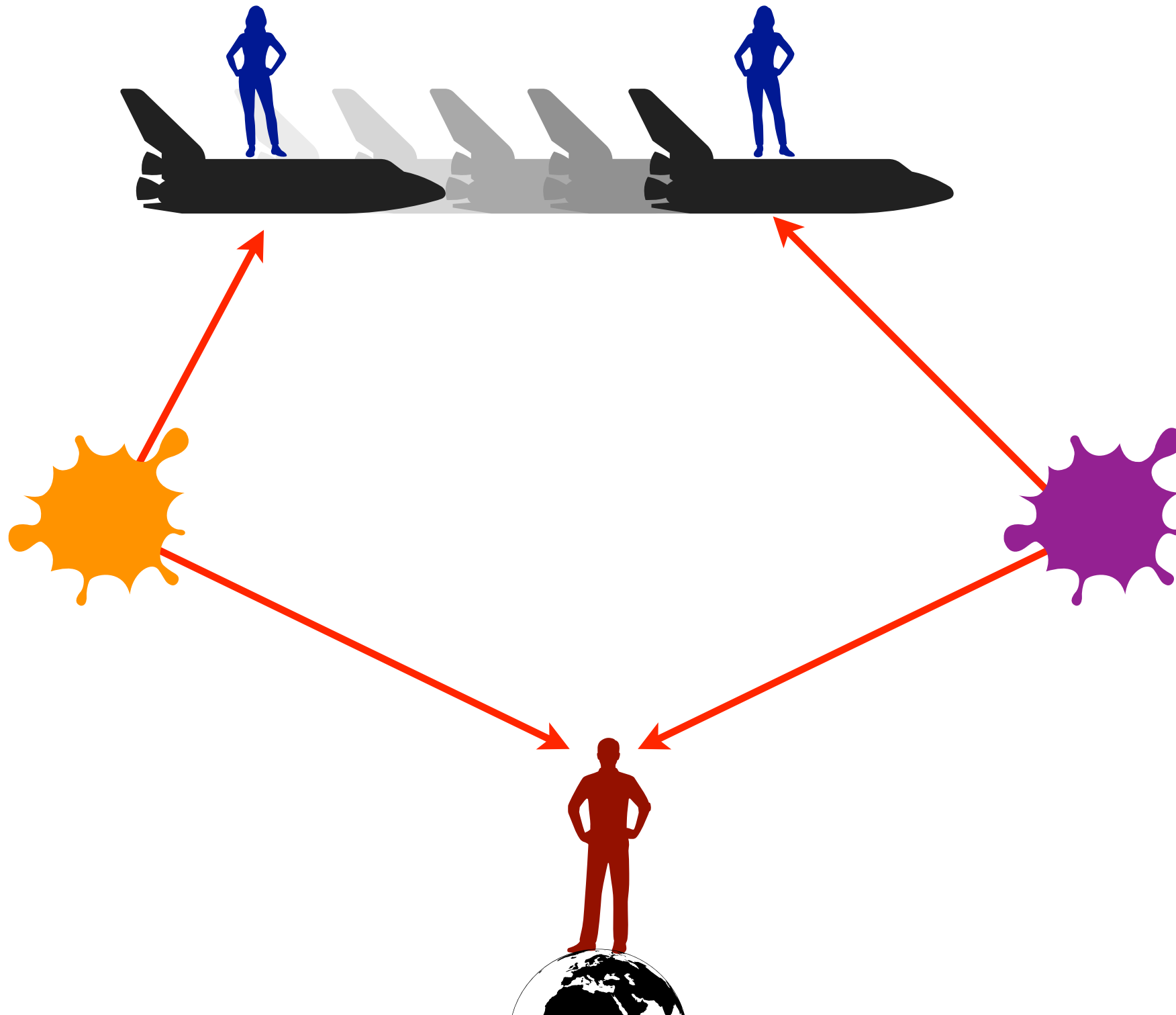
Particle accelerators



Clocks



Simultaneity

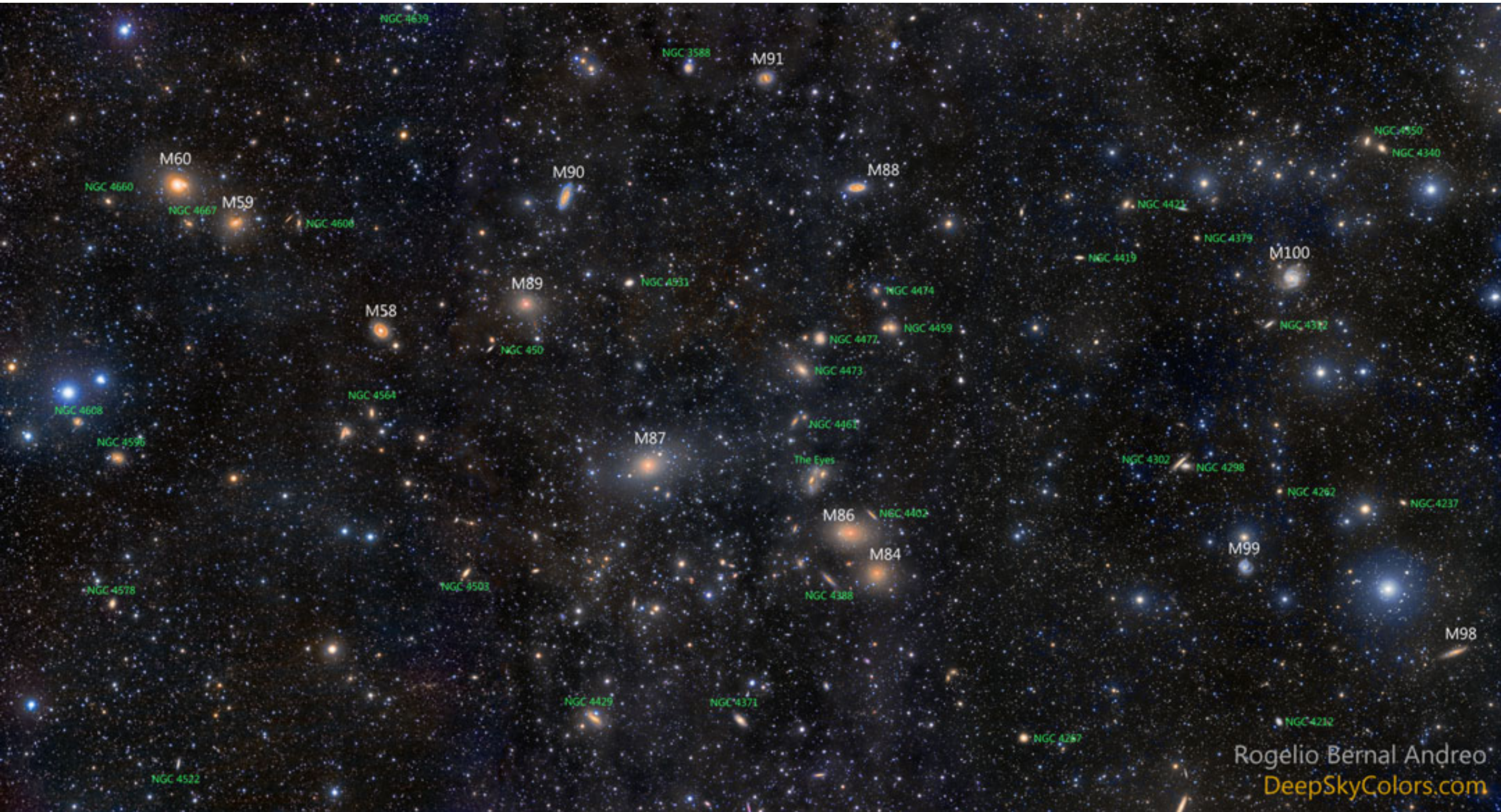


Simultaneity

- Different observers will disagree on which event happened first
- No such thing as absolute time everyone agrees on

Doppler shift

Looking back in time



Special relativity review

- Speed of light is constant... which means
- You see other's clock as running slow
- Different observers disagree on which events happened first, so no absolute time
- Light color can doppler shift (blue coming towards you, red going away)
- We see distant objects as they appear in the past

Measuring distance with light