



White Dwarf Explosions, Hypervelocity Stars, and the Accelerating Expansion of the Universe

Ken Shen (UC Berkeley)

Core collapse supernovae

(Type II, Type Ib, Type Ic)

Gravitational collapse of
(initially) massive stars,
>10x the mass of the Sun

Type Ia supernovae

Thermonuclear explosions
of white dwarfs

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SN 2011fe

06 Feb. 2011

The Virtual Telescope Project (www.virtualtelescope.eu)

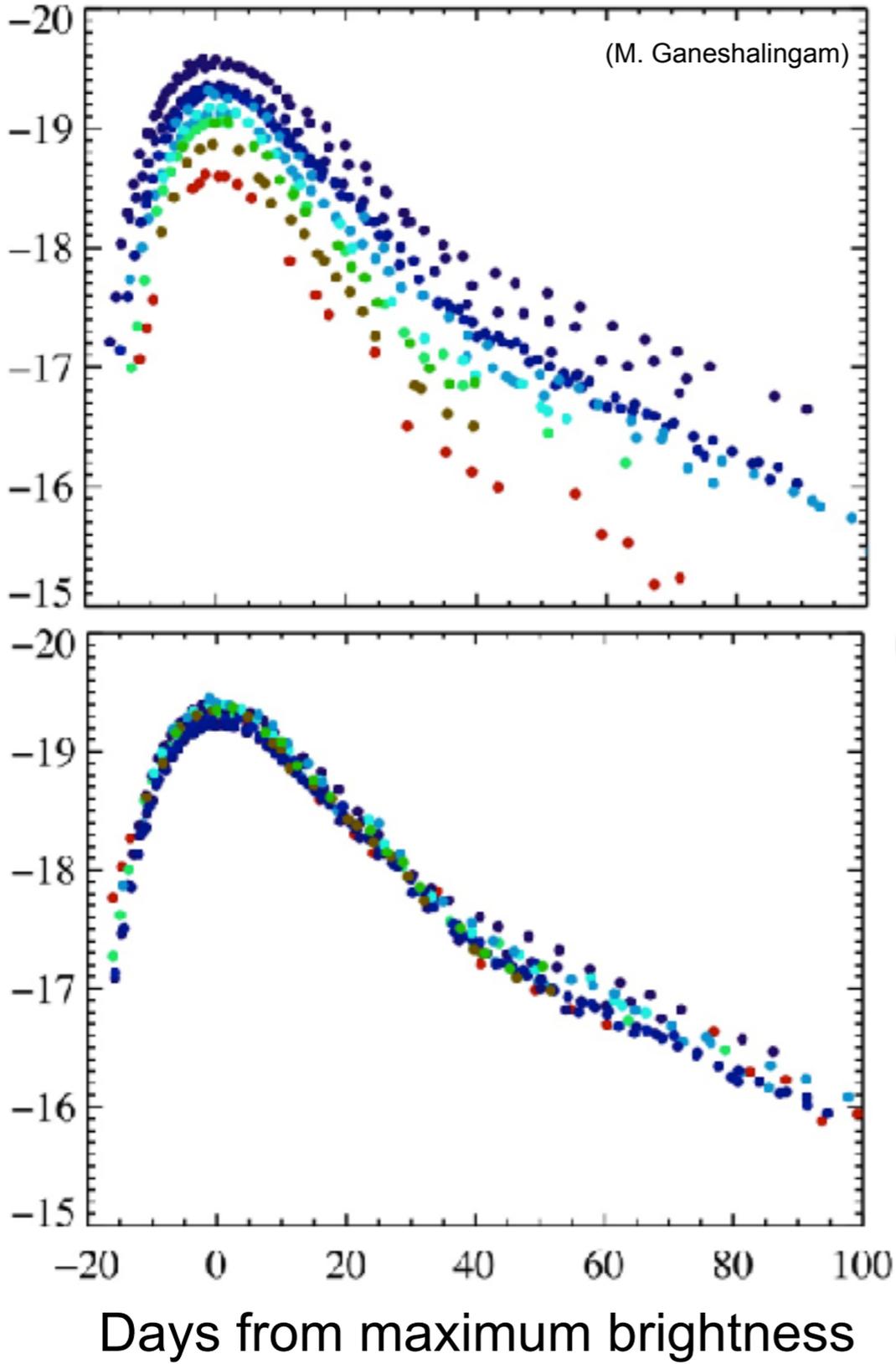
CORRECTED BRIGHTNESS →

BRIGHTNESS →

Corrected absolute

B-band magnitude

Absolute B-band magnitude

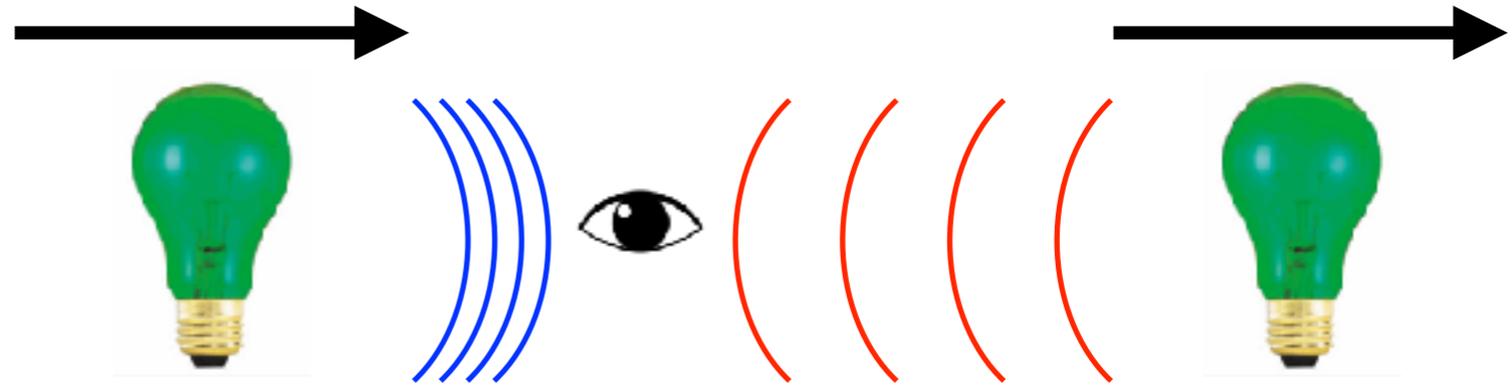


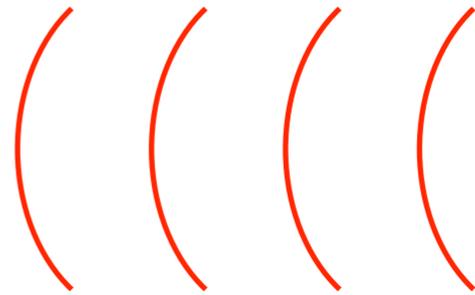
Earth

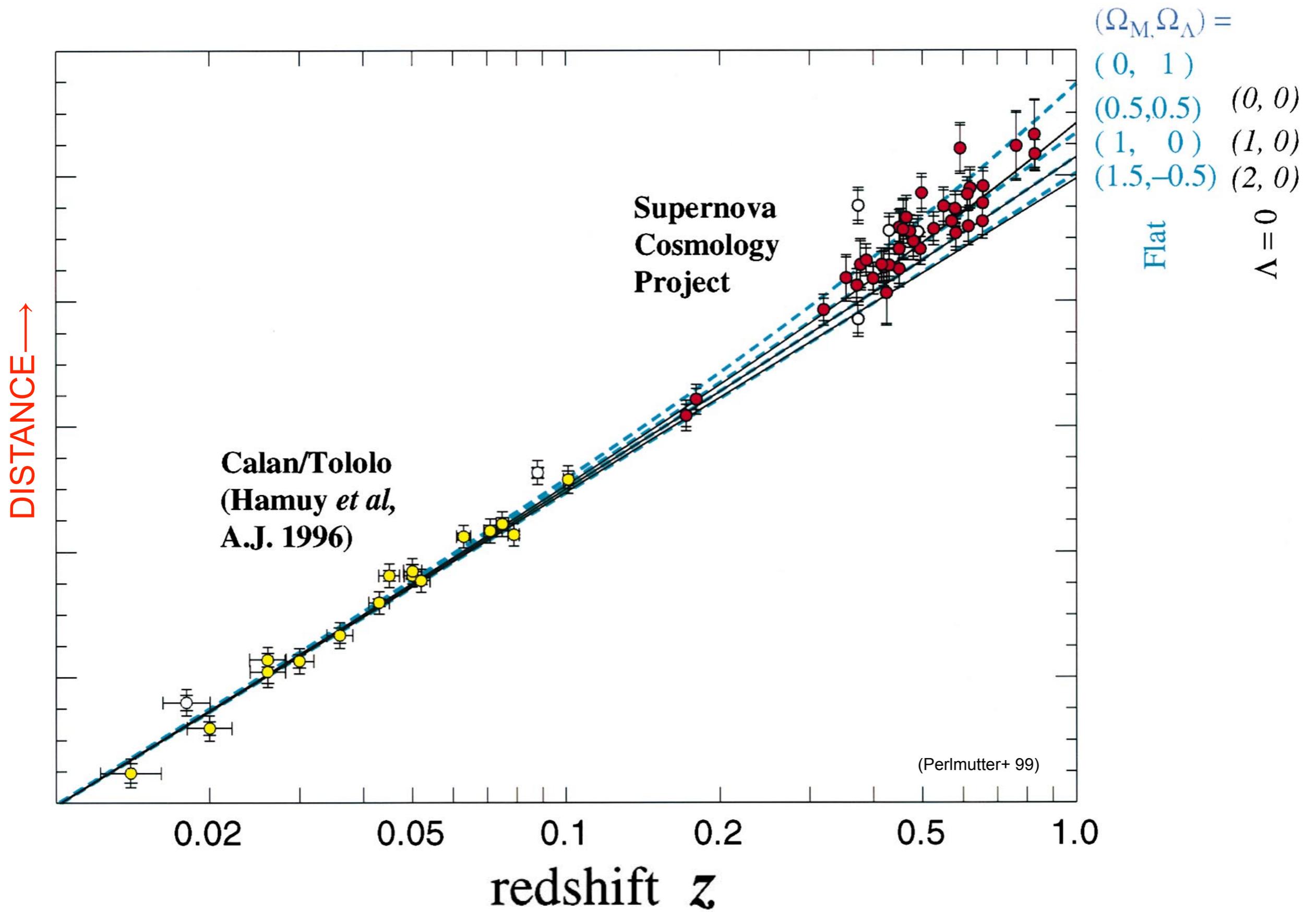


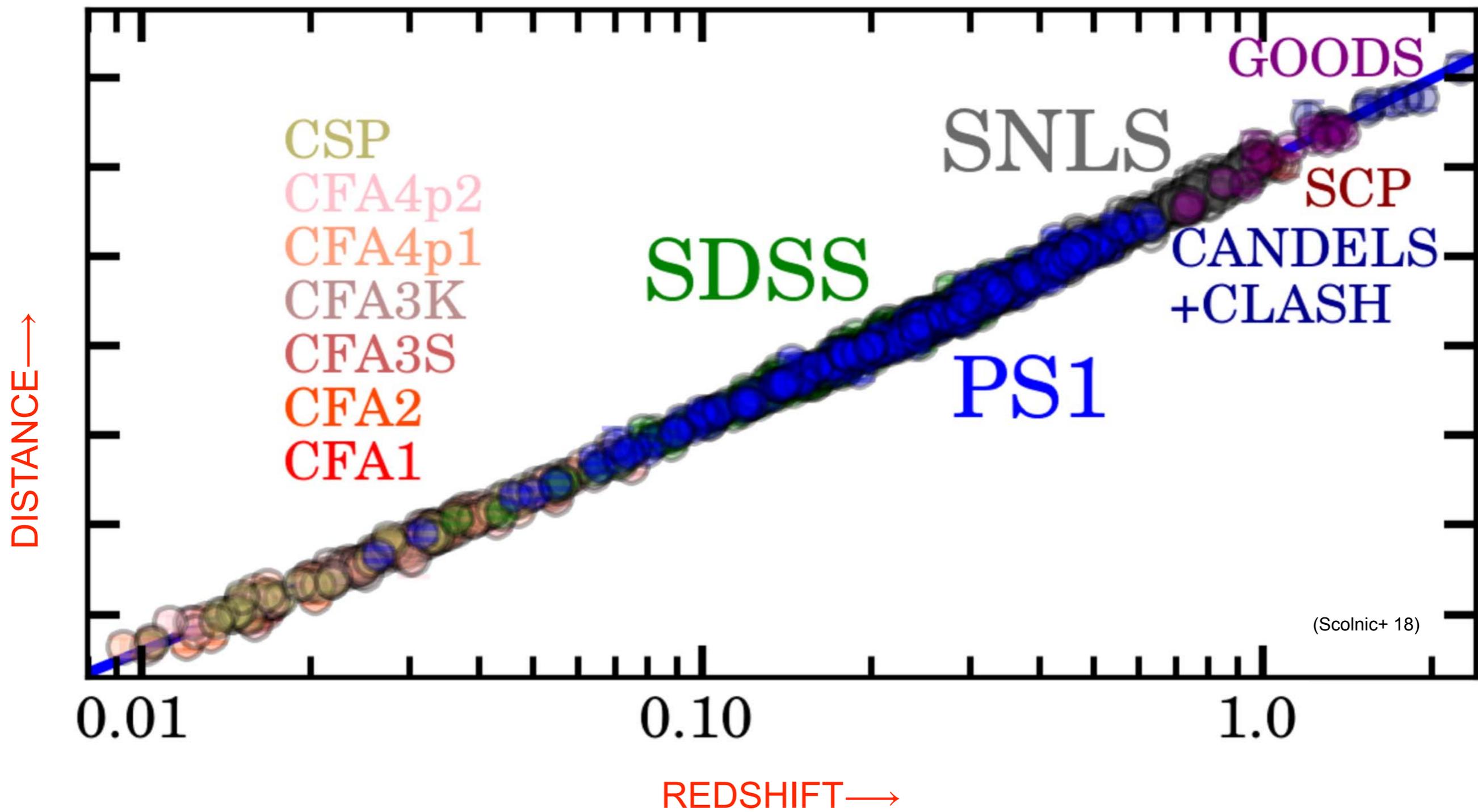
Longer wavelength
Lower frequency

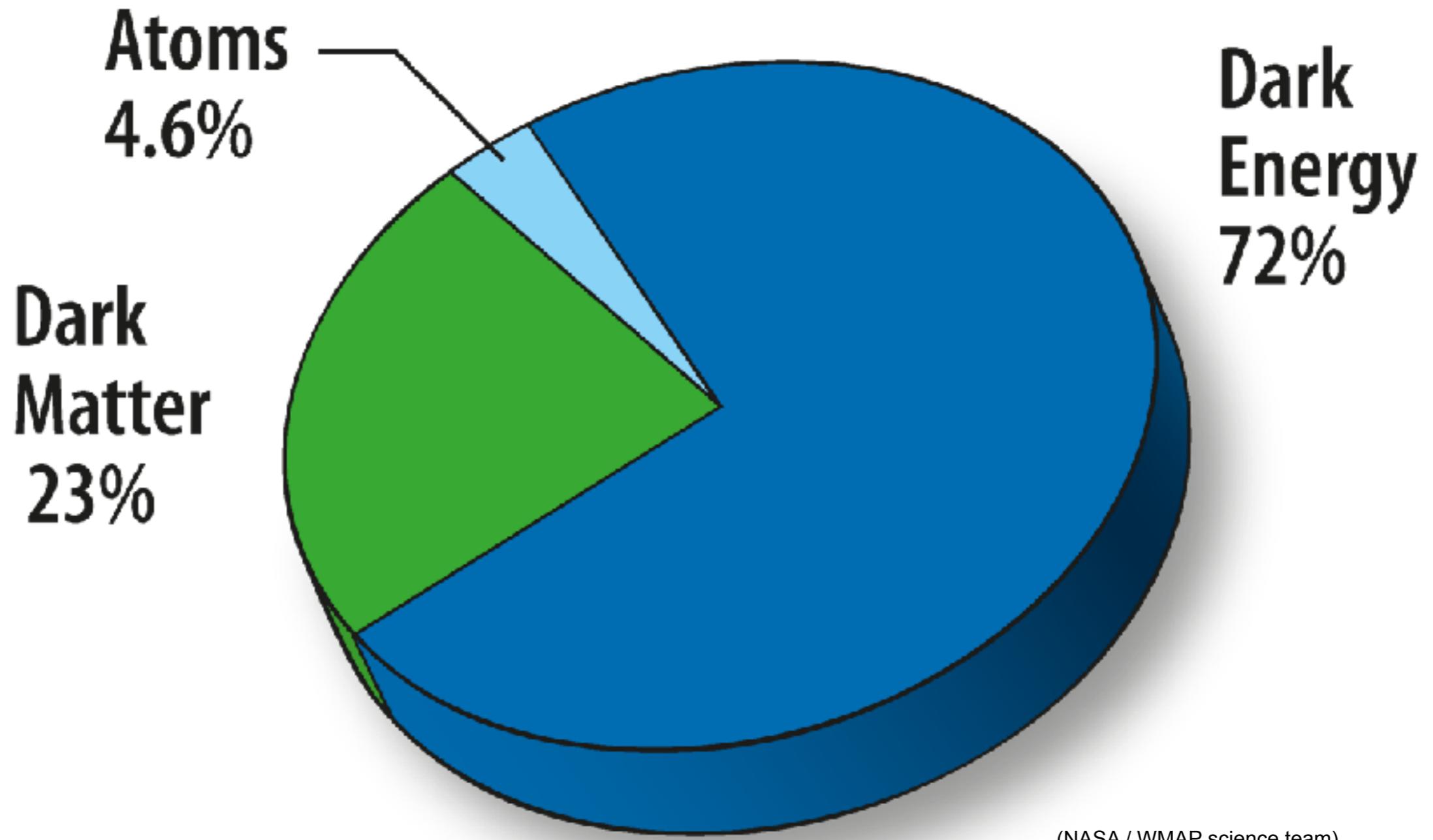
Shorter wavelength
Higher frequency











(NASA / WMAP science team)



Saul Perlmutter



Adam Riess



Brian Schmidt



(U. Montan)

Supernova Cosmology Project

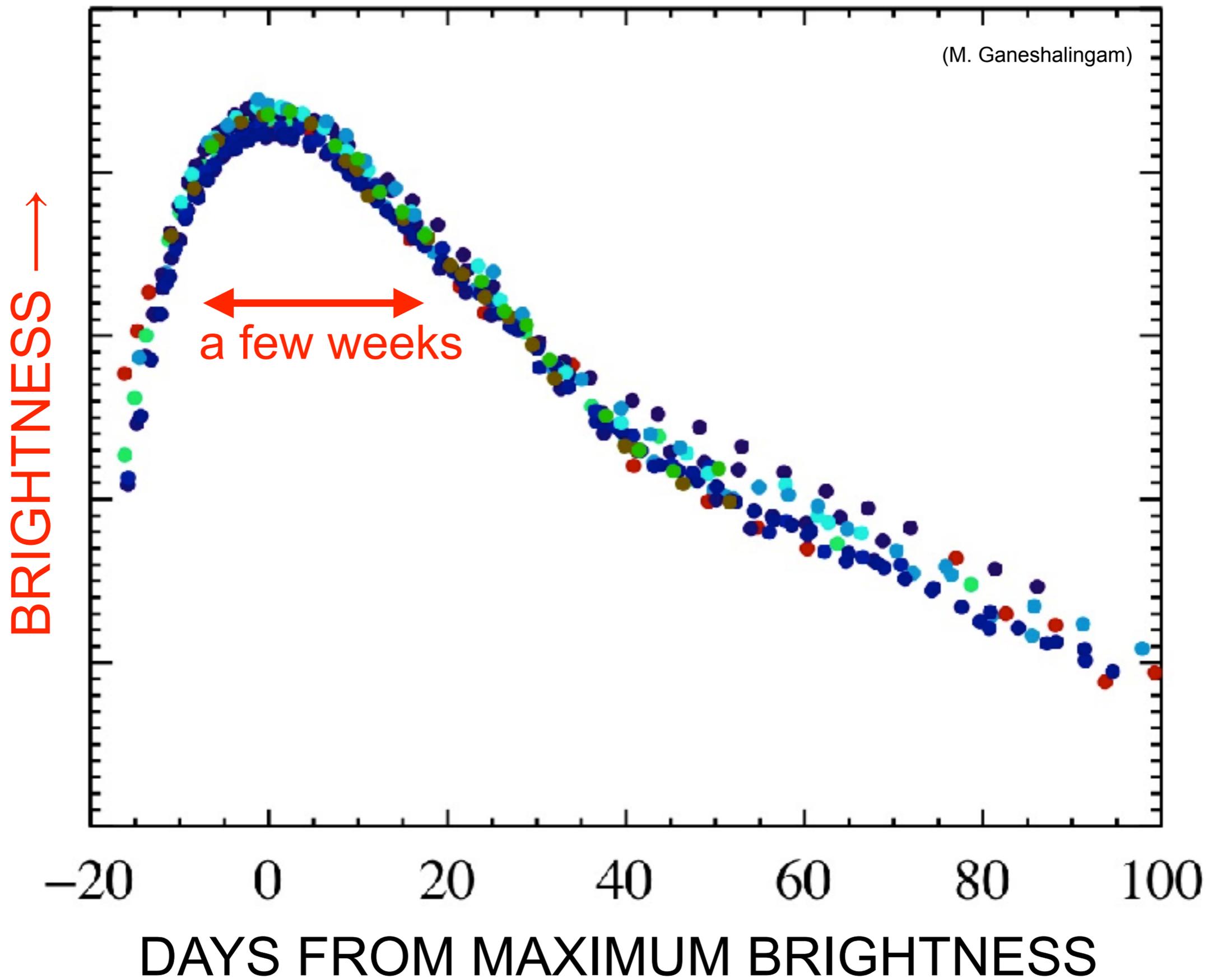


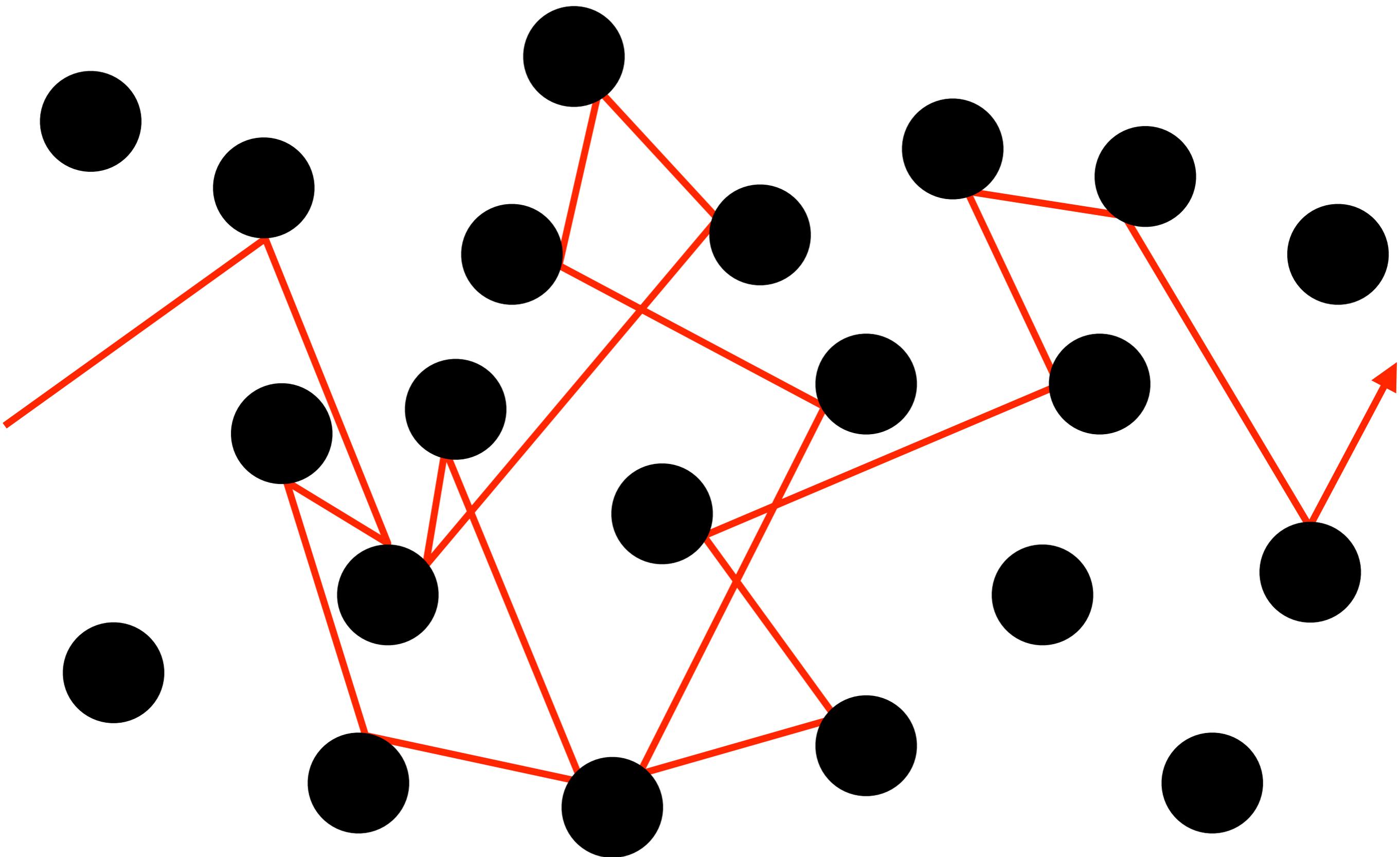
(R. Knop)

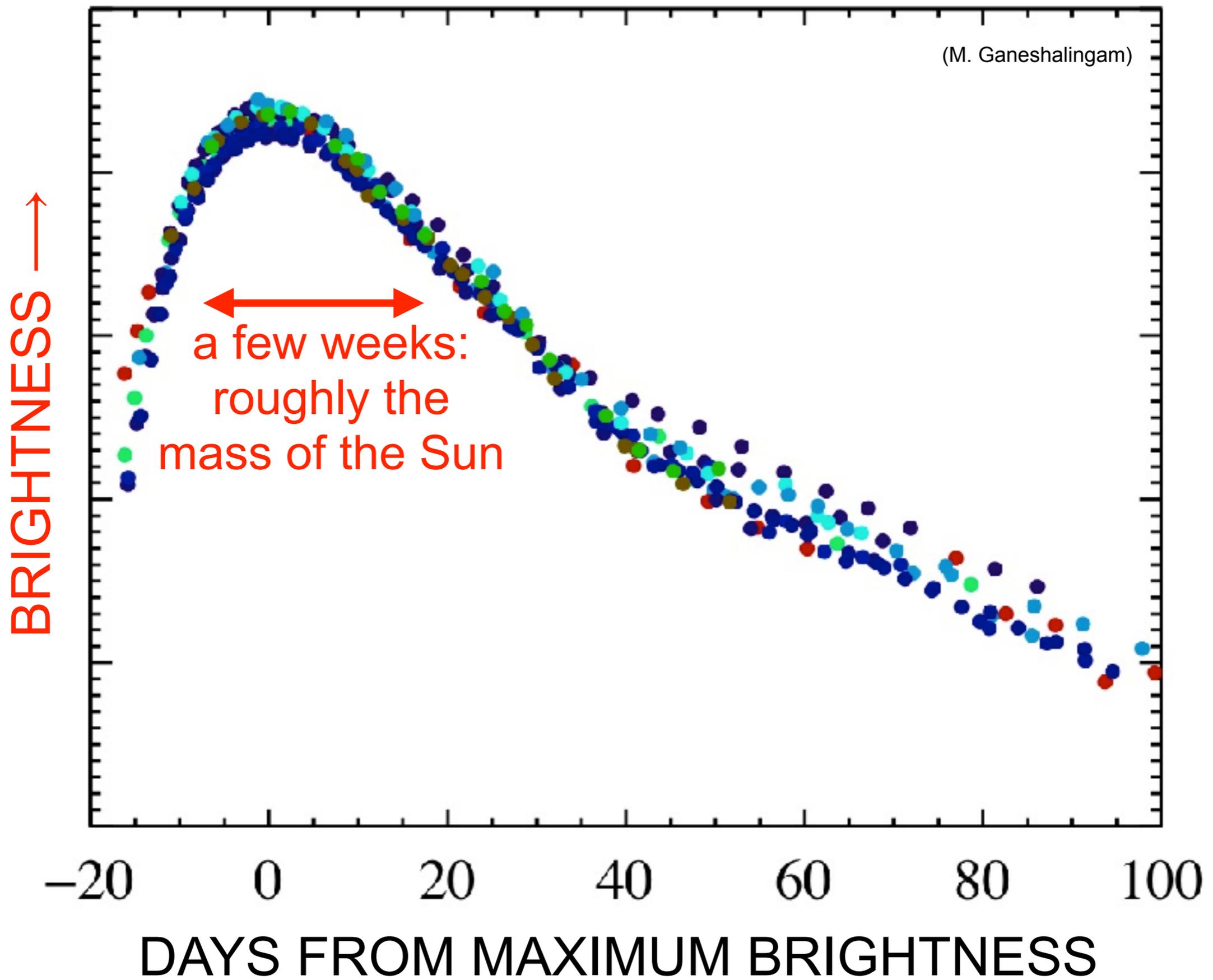
High-Z team

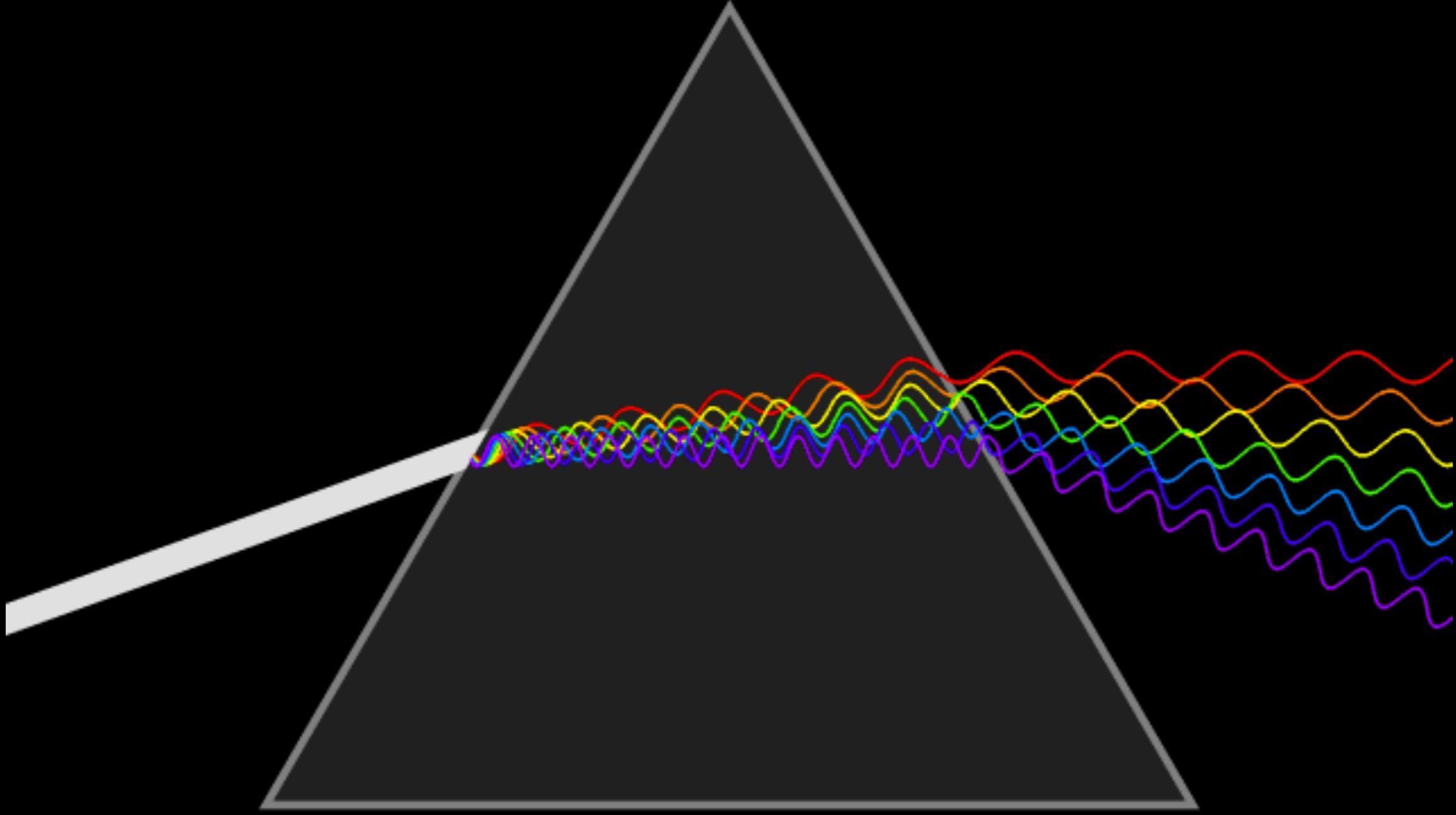


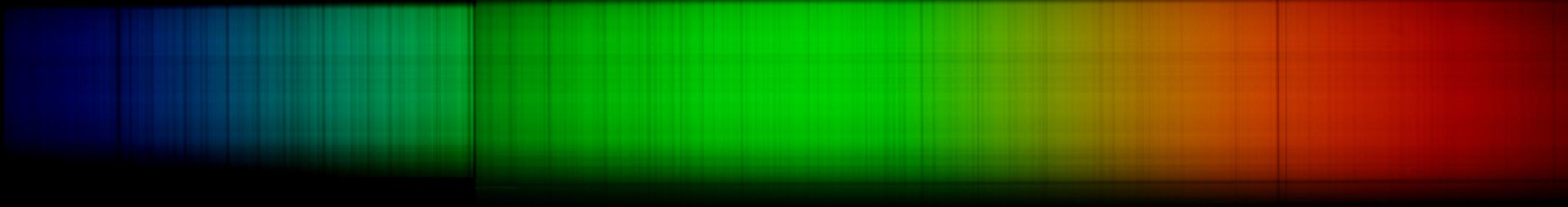
(cfa.harvard.edu)



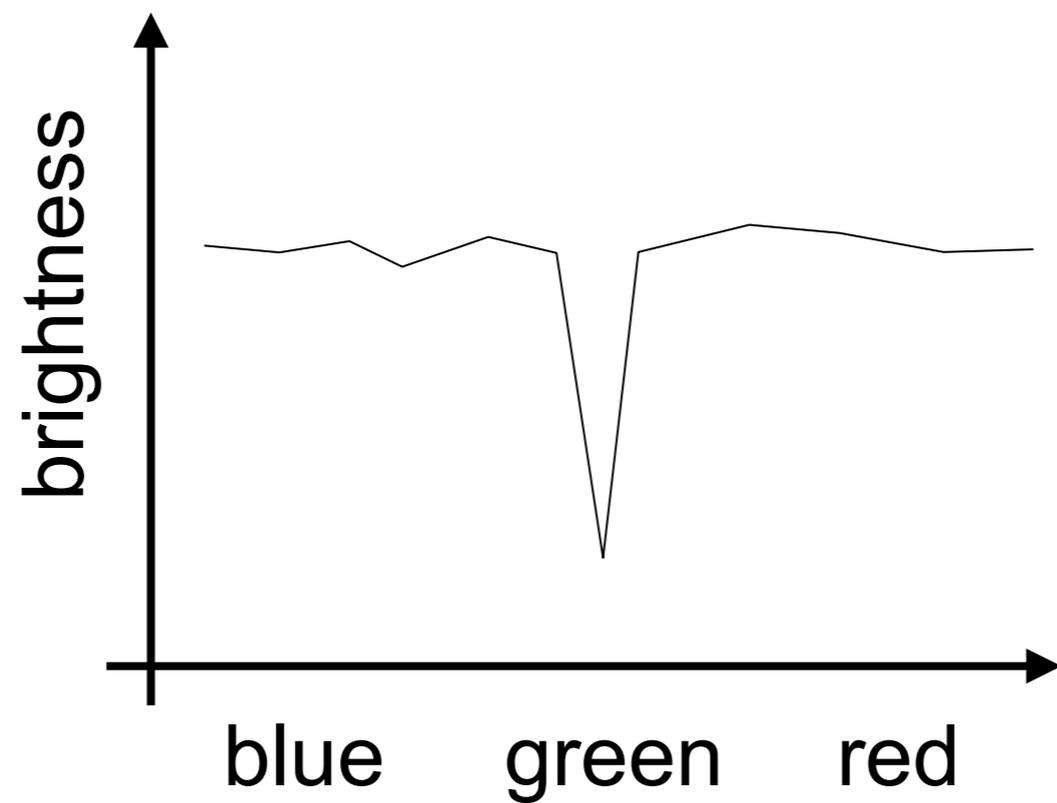
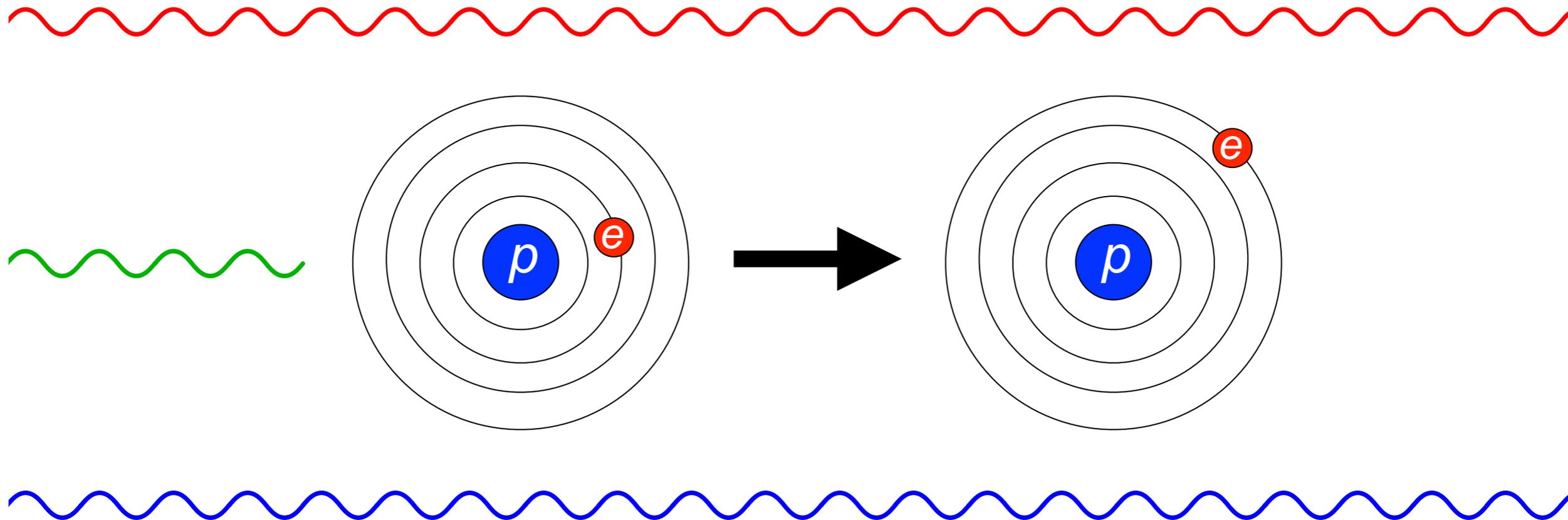




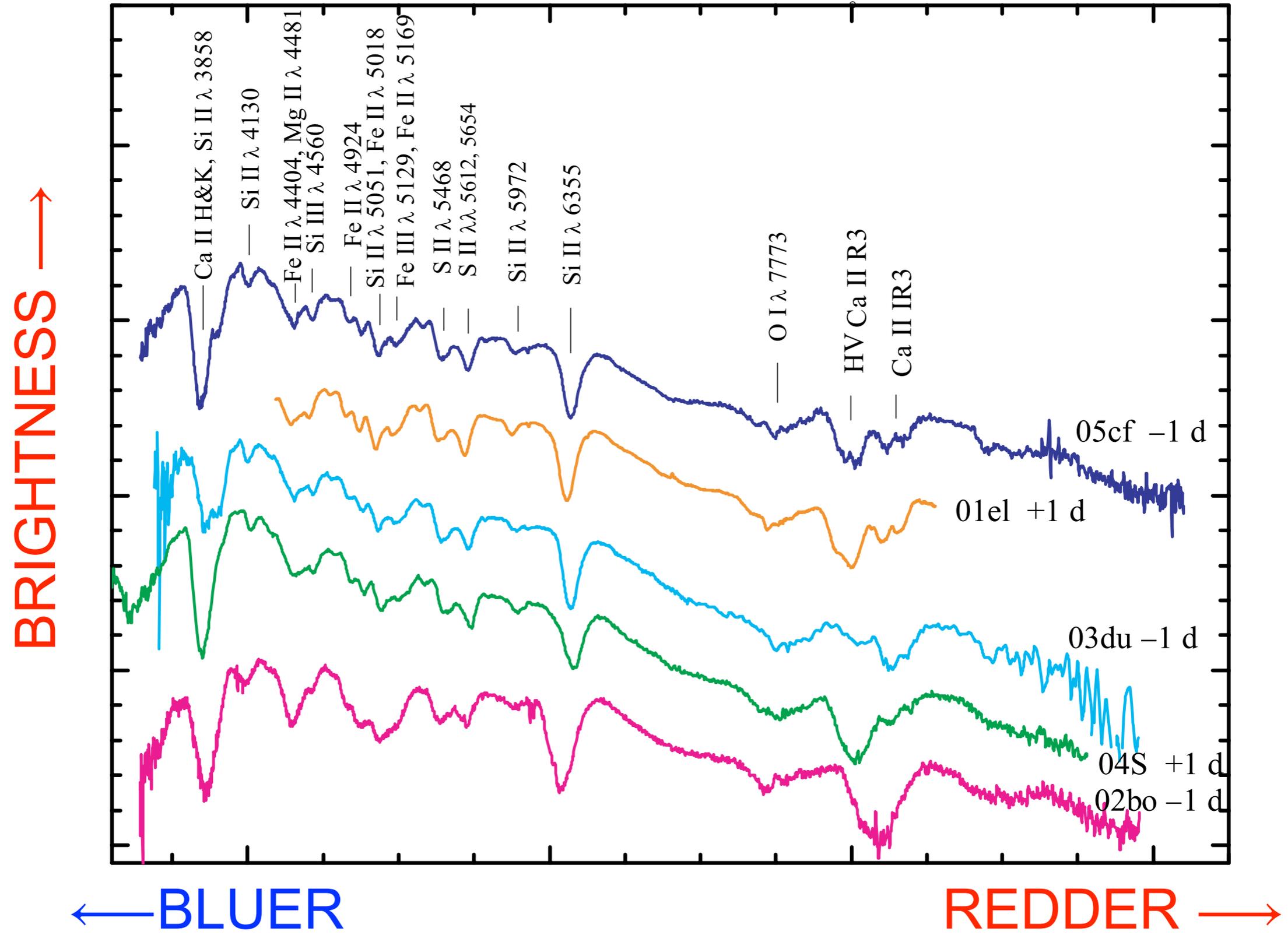


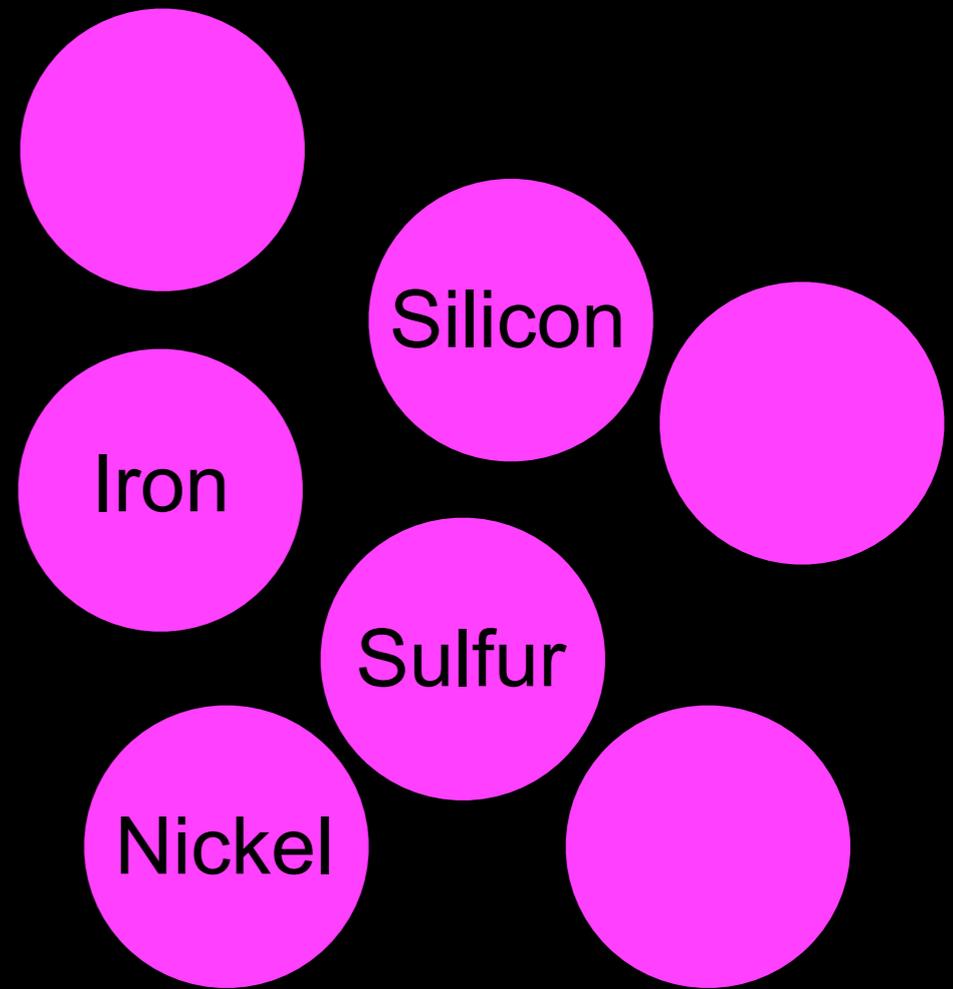
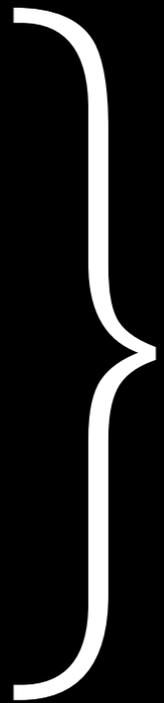
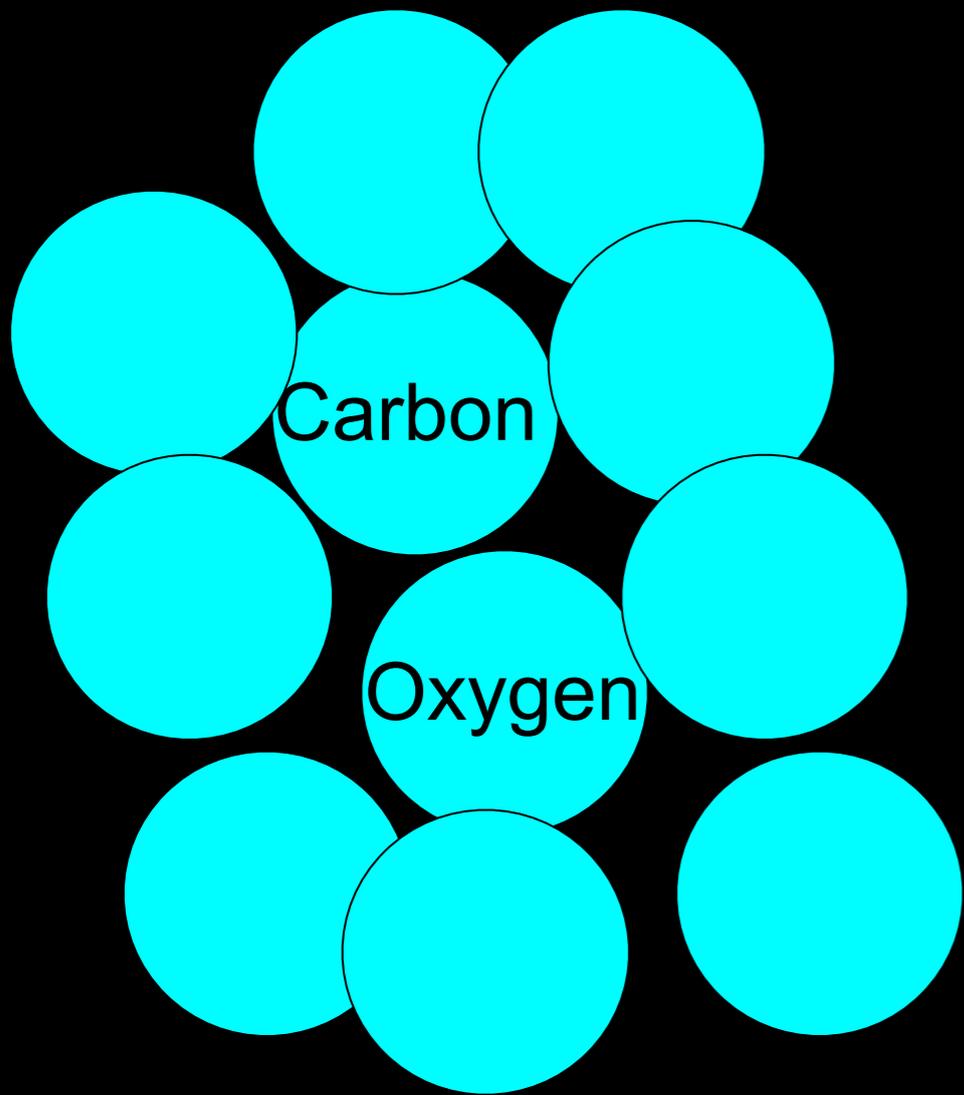


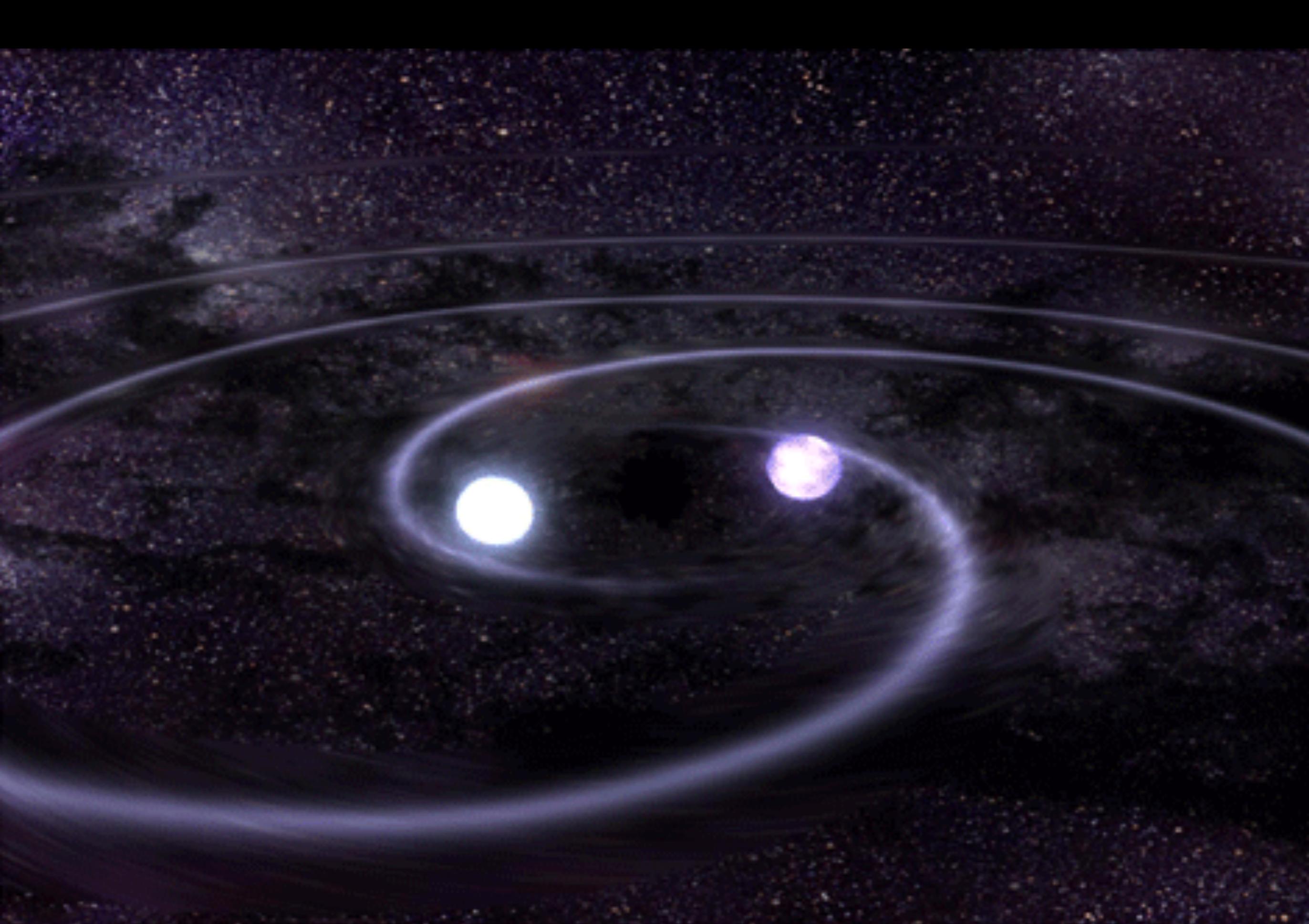
bu.edu/astronomy

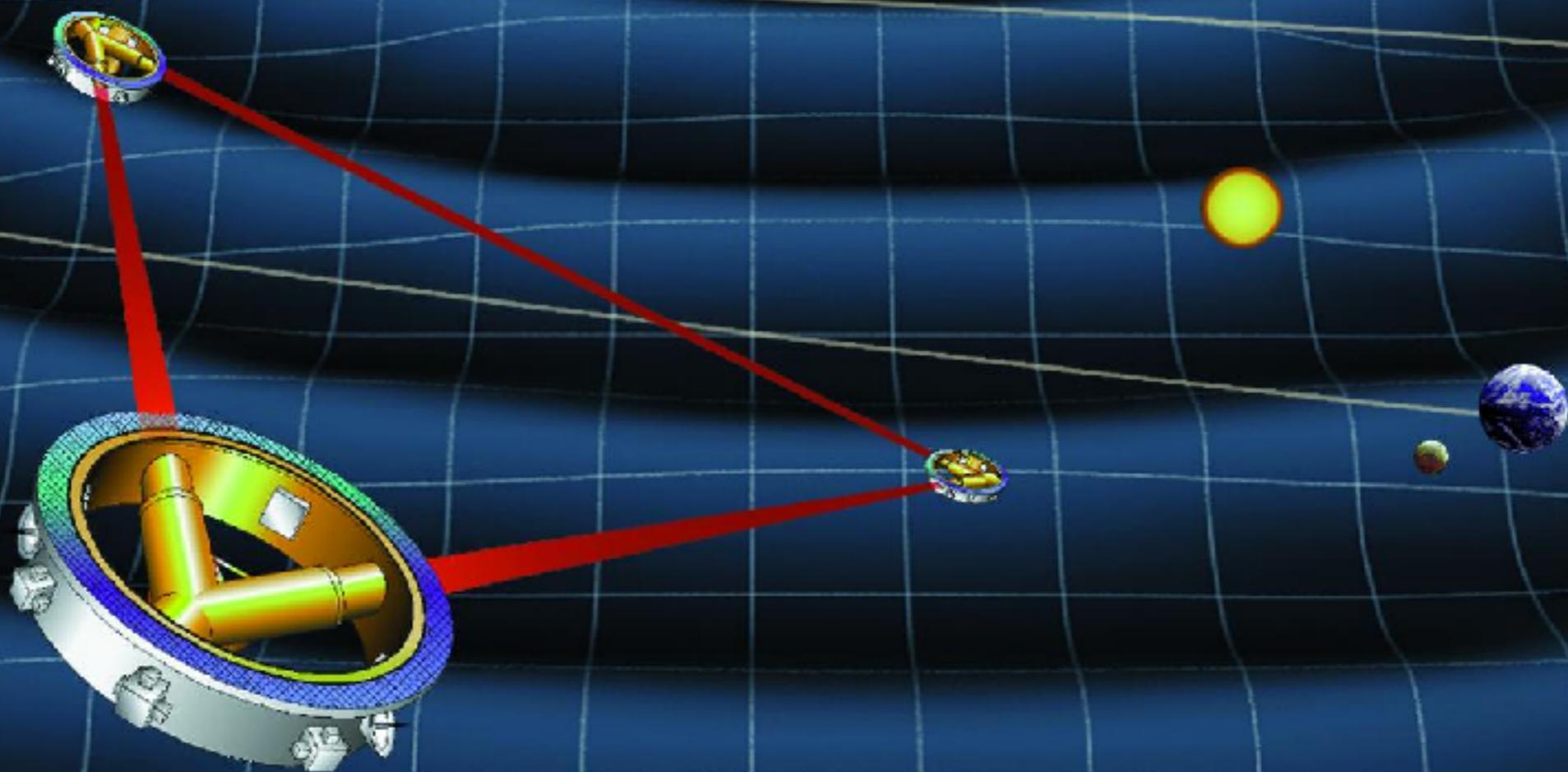
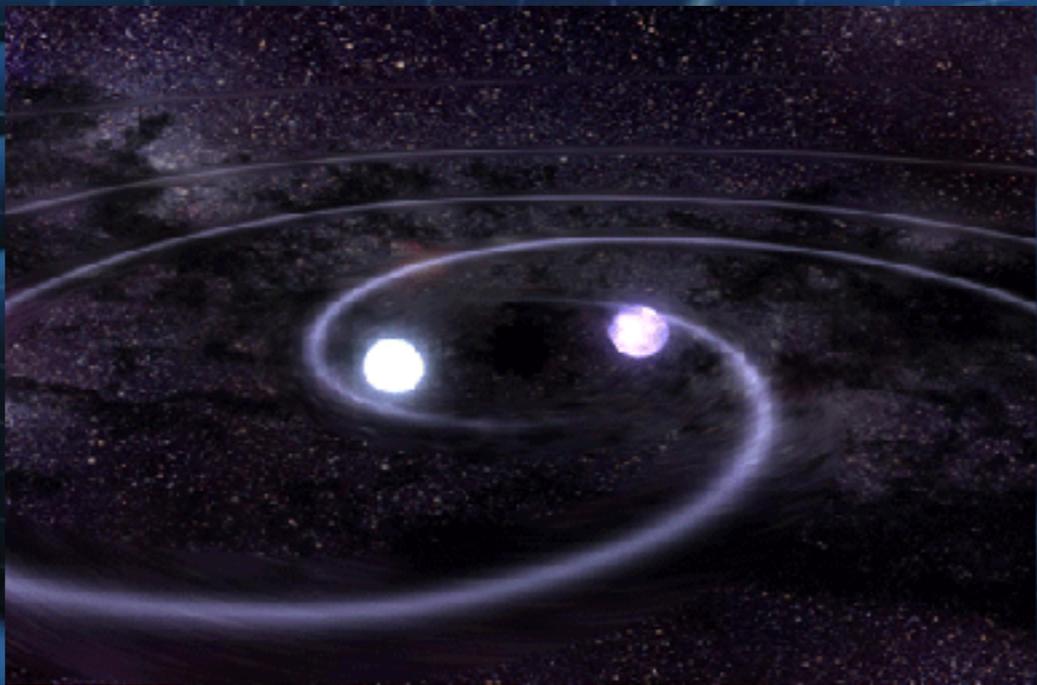


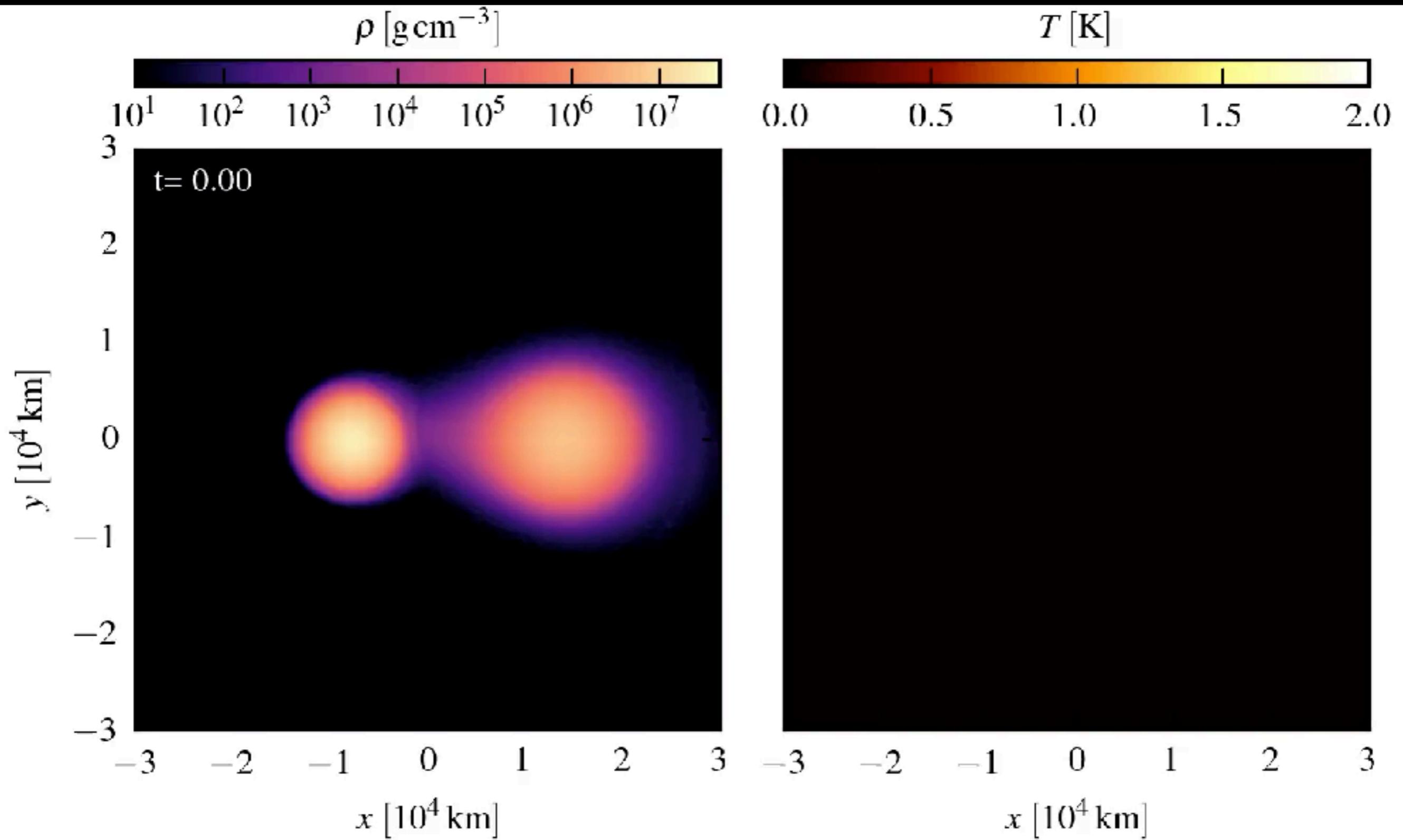
(Wang+ 09)

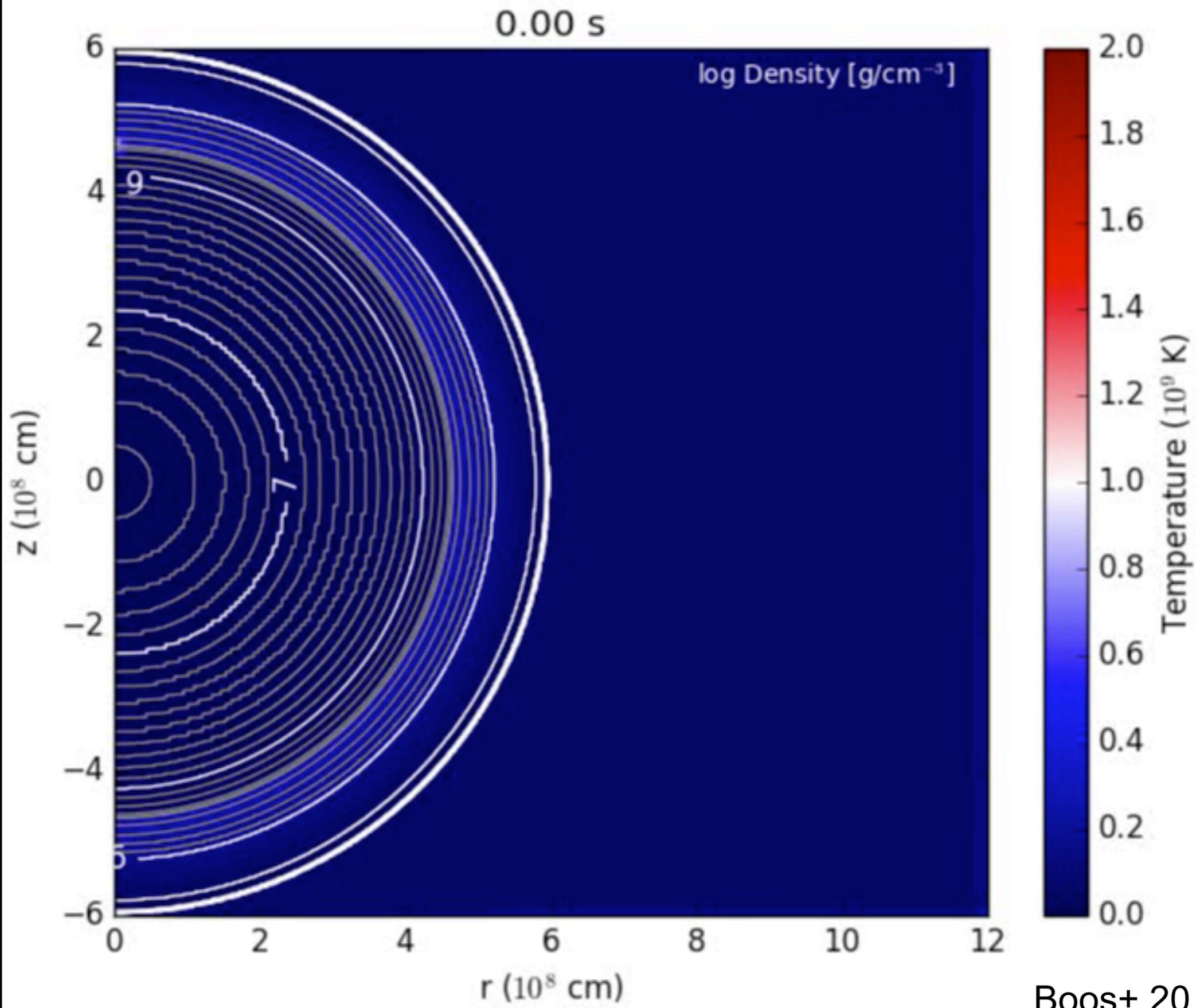






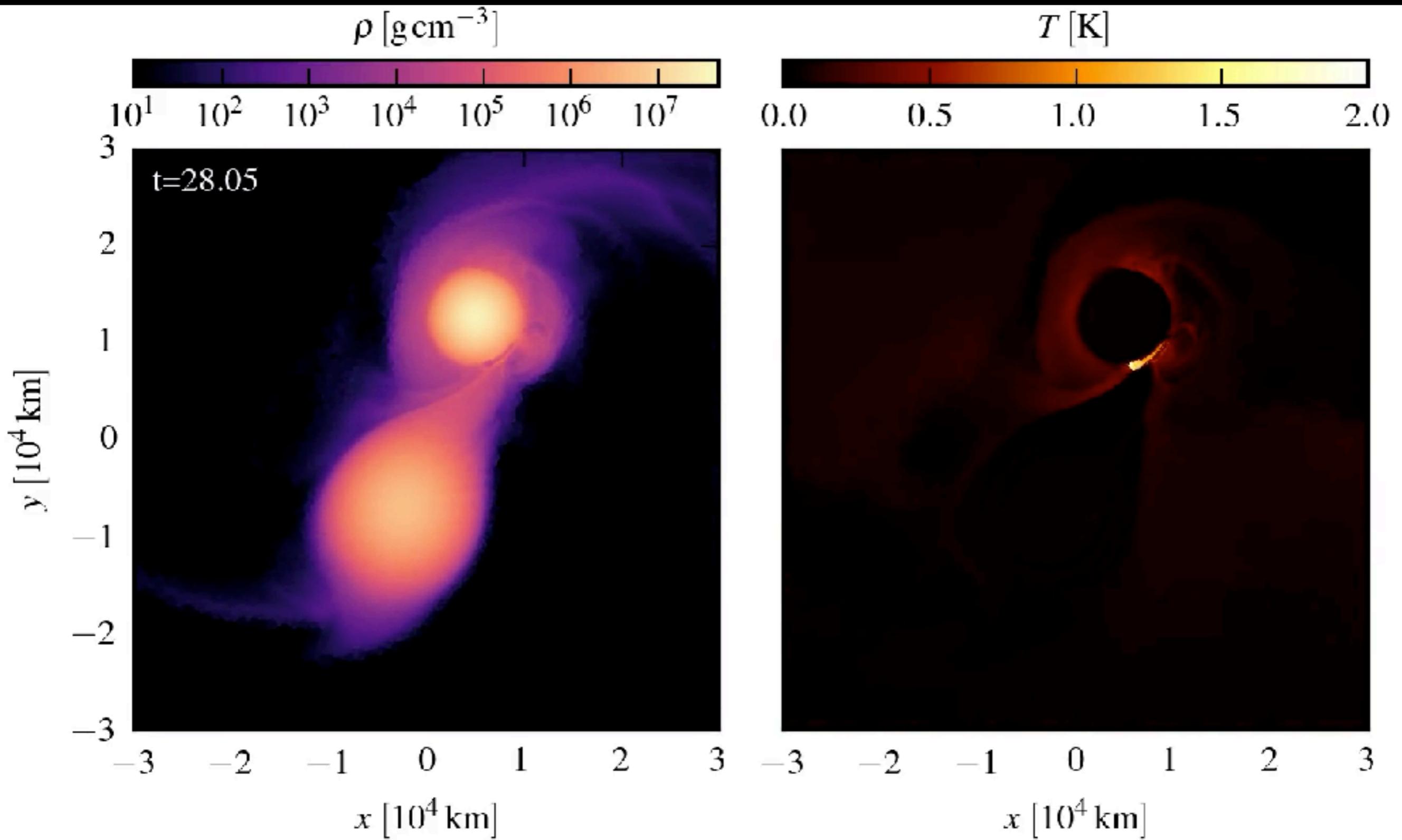


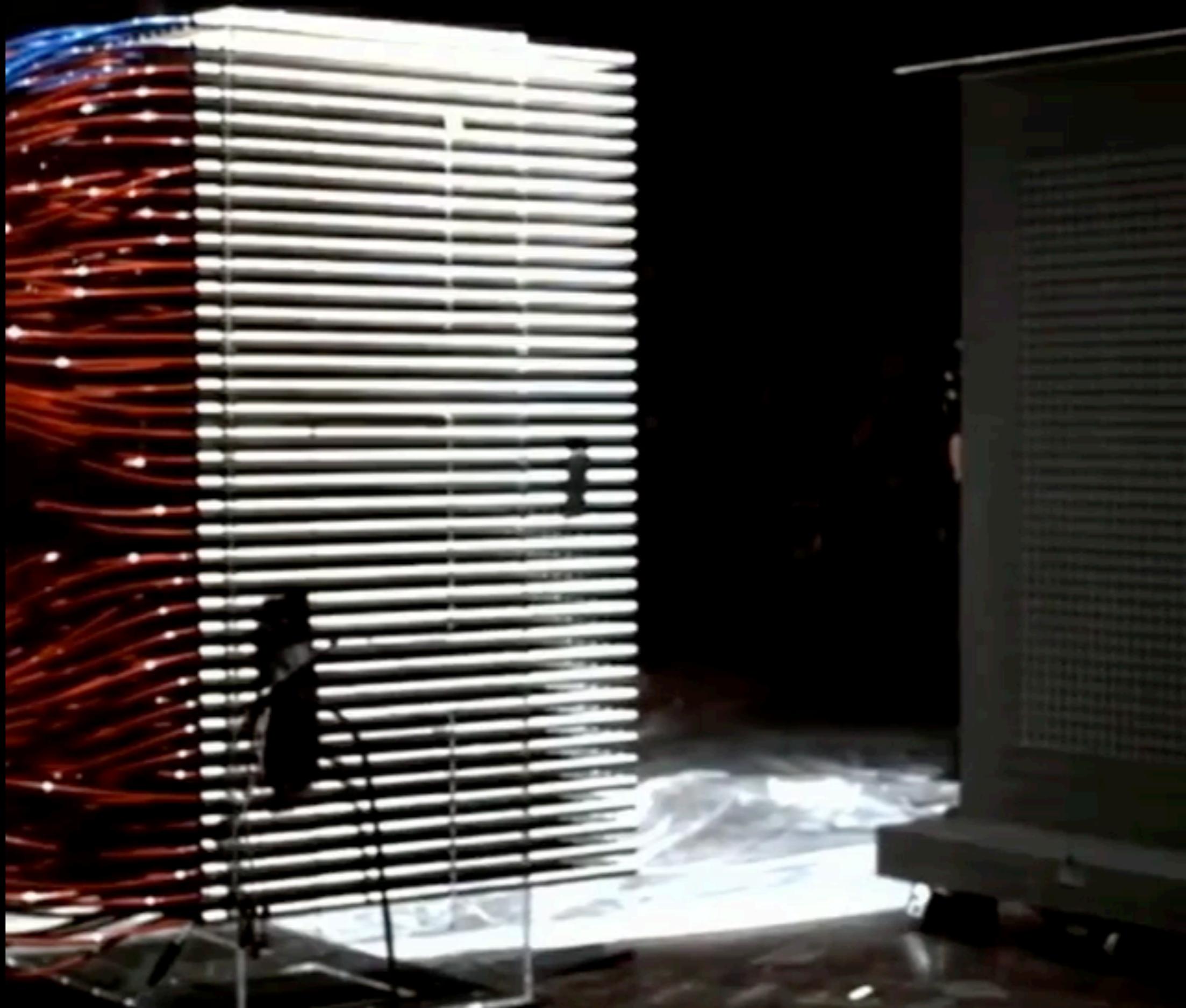


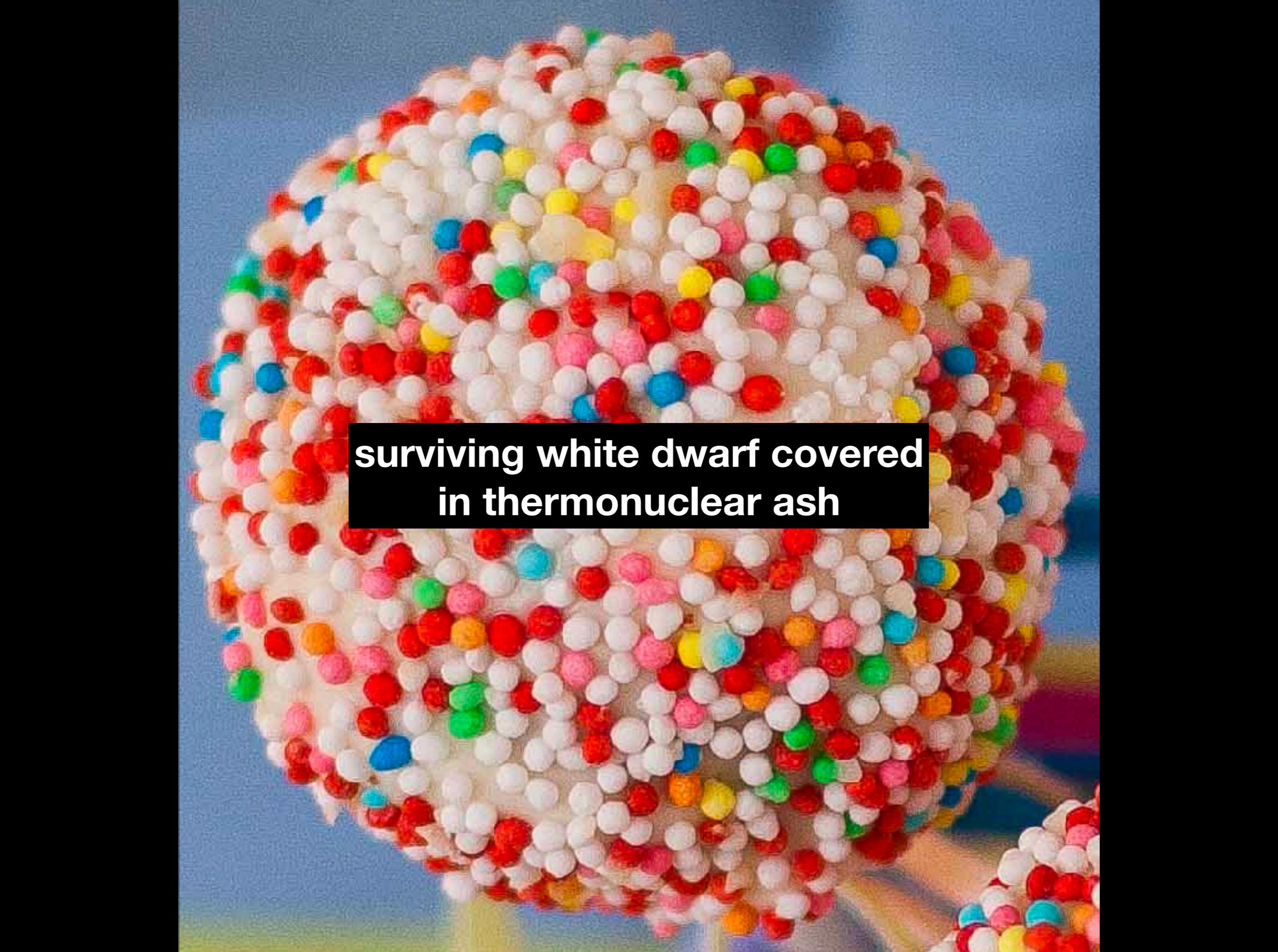




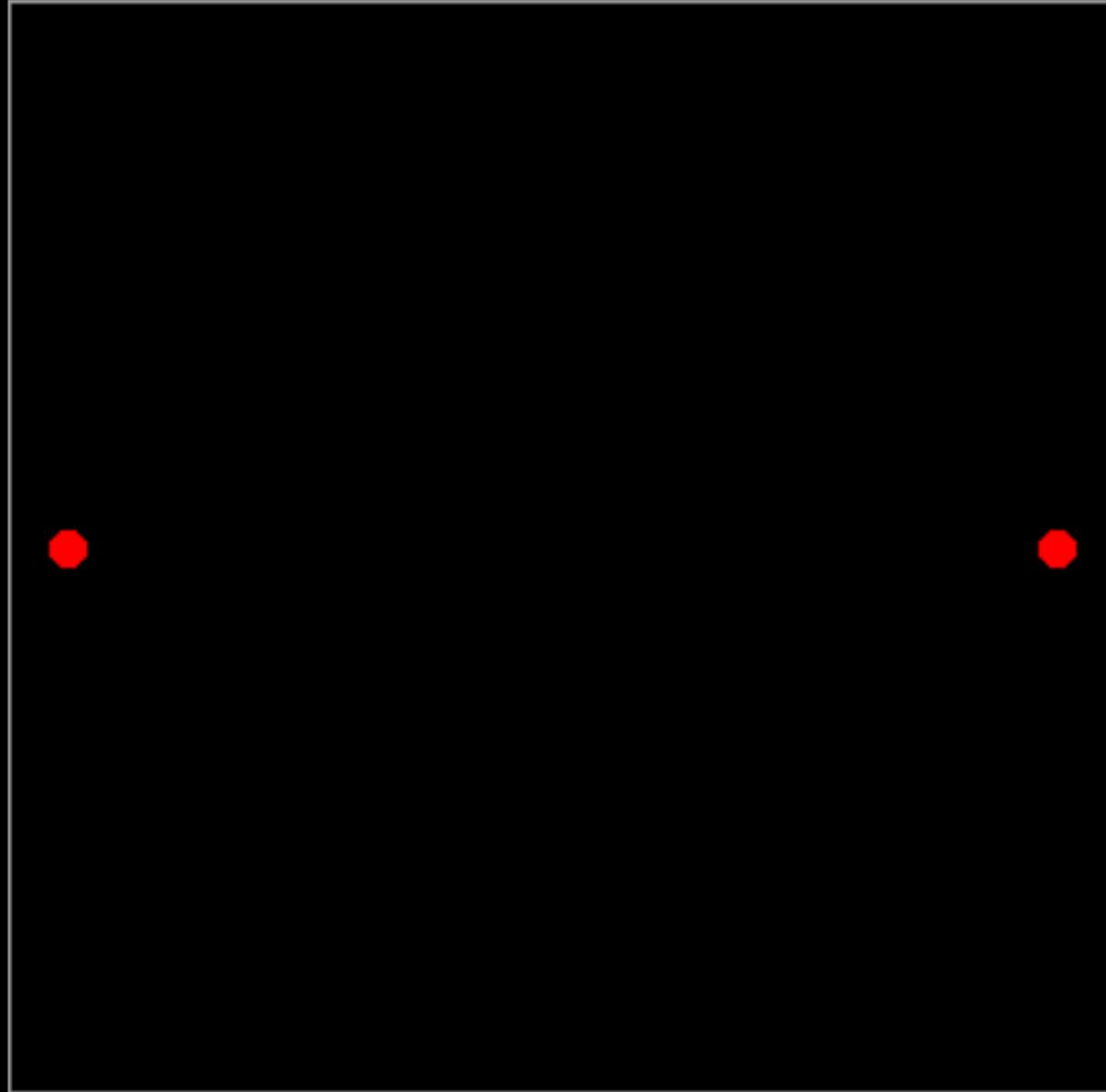
M. Versluis





A large, round cake is the central focus, completely covered in white frosting and a dense layer of multi-colored sprinkles. The sprinkles are in various colors including red, blue, yellow, green, pink, and orange. The cake is set against a light blue background. A black rectangular box with white text is overlaid on the center of the cake.

**surviving white dwarf covered
in thermonuclear ash**





2500 km/s = 1% the speed of light!

- **Berkeley - NY in < 2 seconds**
- **Earth to Moon in 2.5 minutes**
- **ejected from the Milky Way in 4 million years**
- **could reach Andromeda in 300 million years!**



Three Hypervelocity White Dwarfs in *Gaia* DR2: Evidence for Dynamically Driven Double-degenerate Double-detonation Type Ia Supernovae

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- **We found 3 stars with the right speeds (>1000 km/s) and compositions (covered in thermonuclear ash)**
- **And one points back to the remnant of a supernova!**
- **But do all Type Ia supernovae happen this way?**
- **And are there subtle effects that might change cosmology results?**