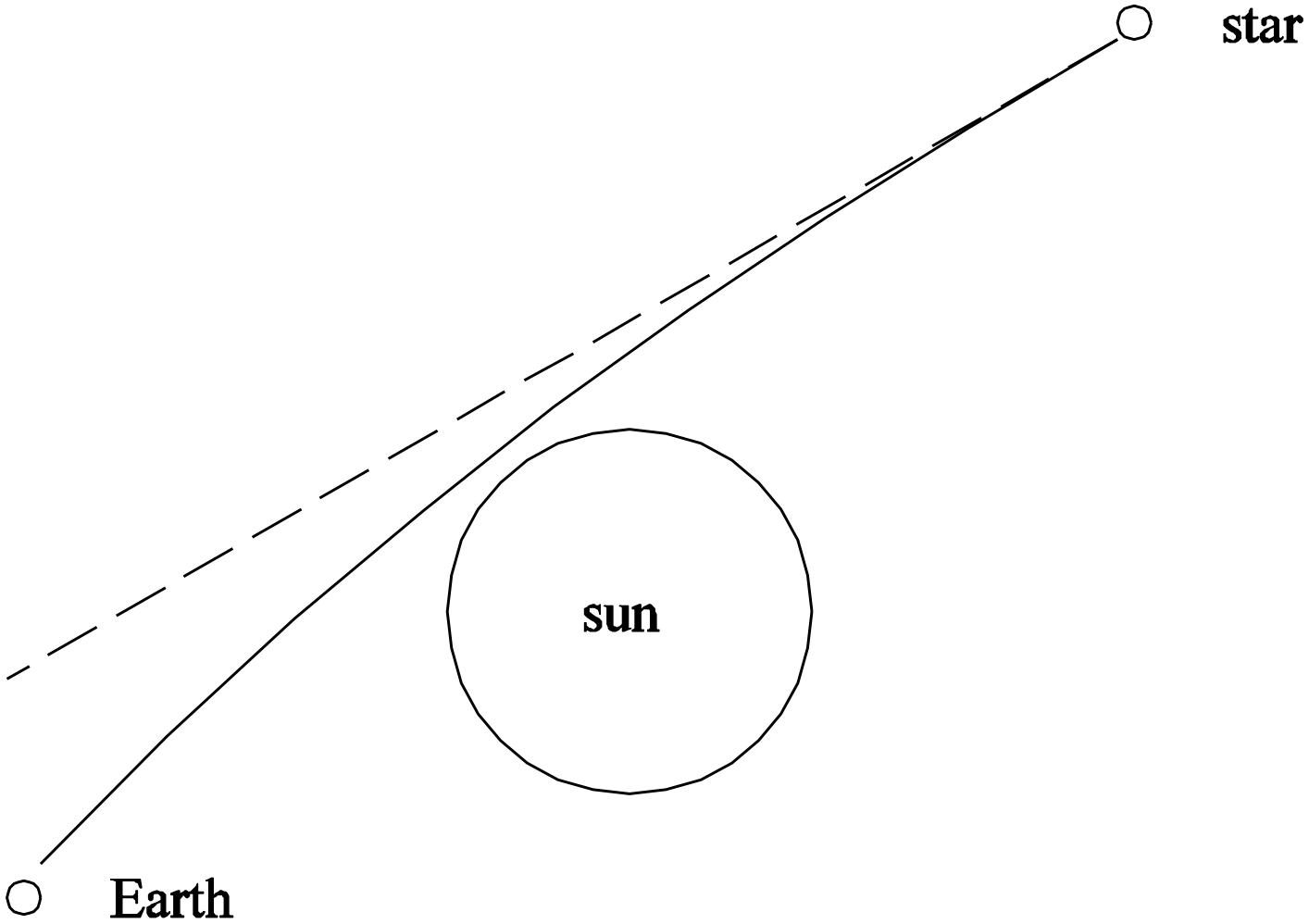
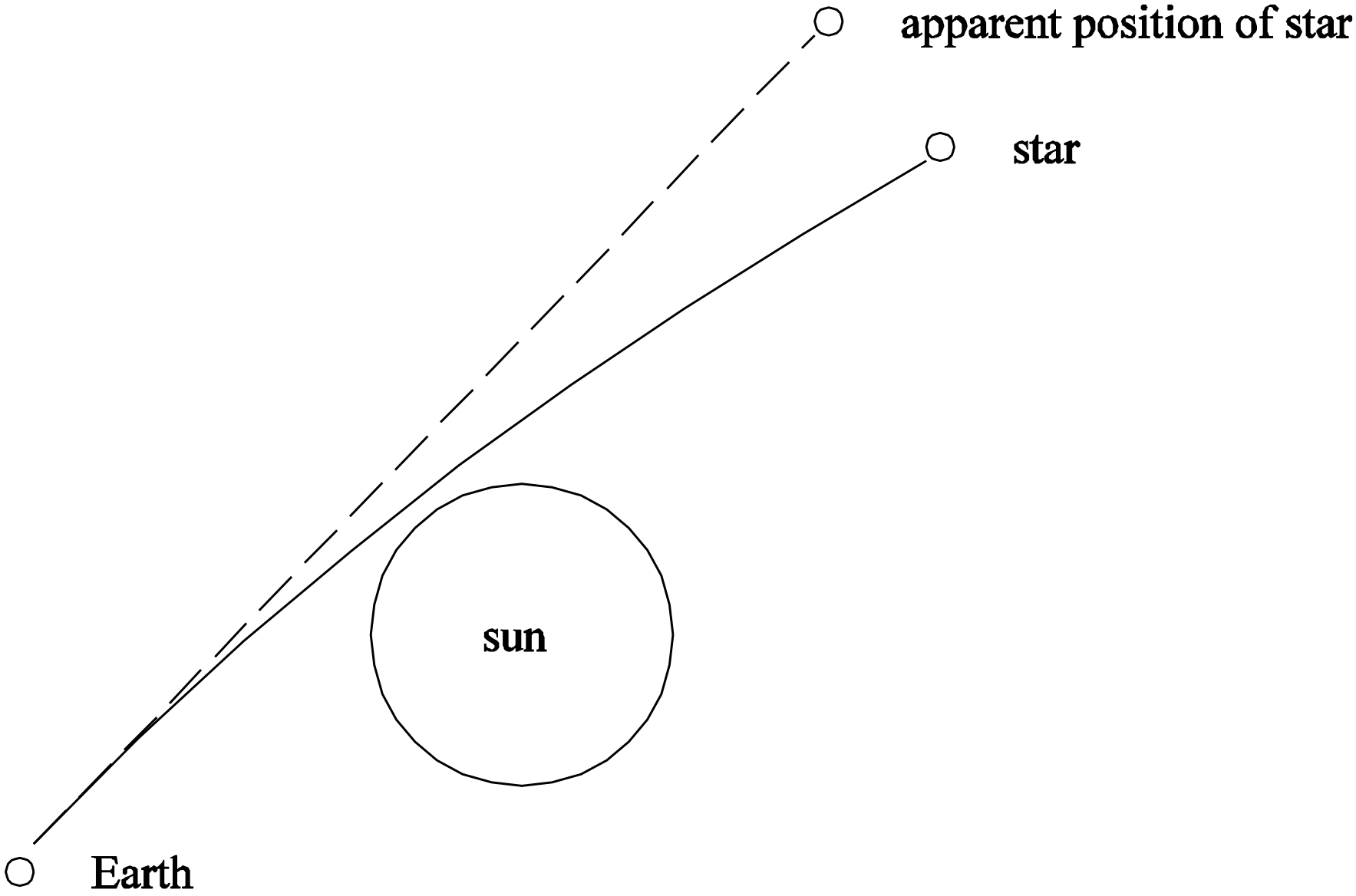
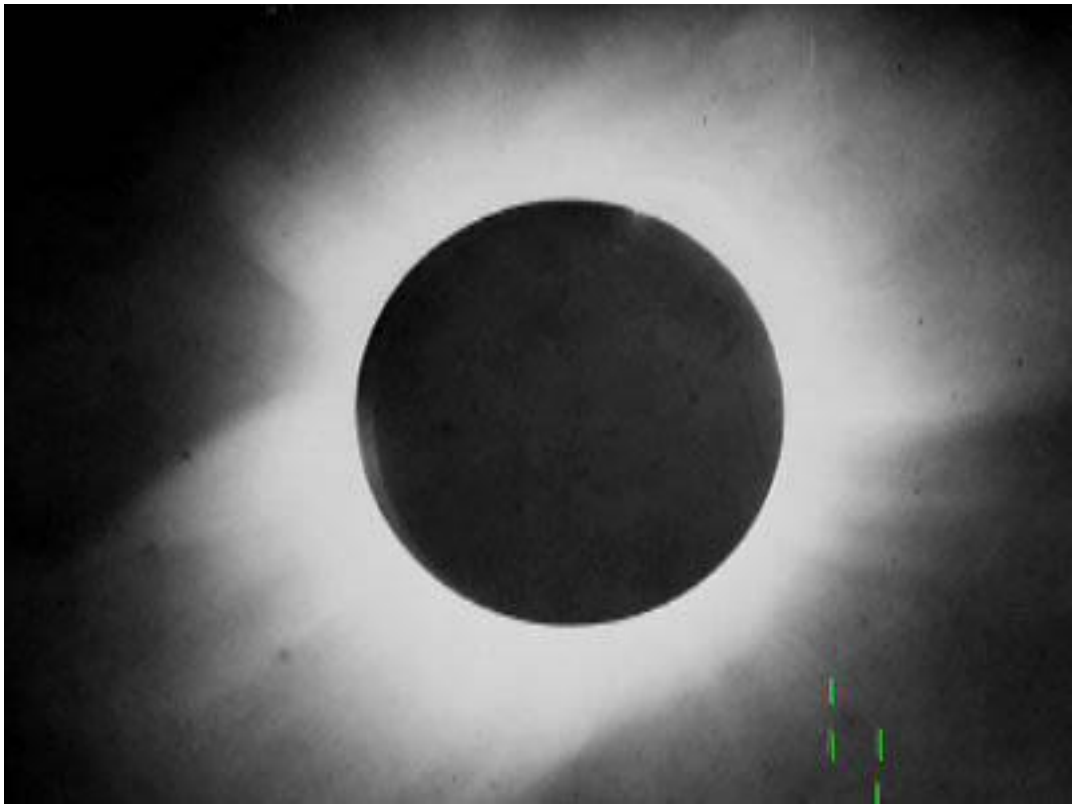
Is the path of light bent by gravity?

Dan Styer
Oberlin College
Department of Physics and Astronomy

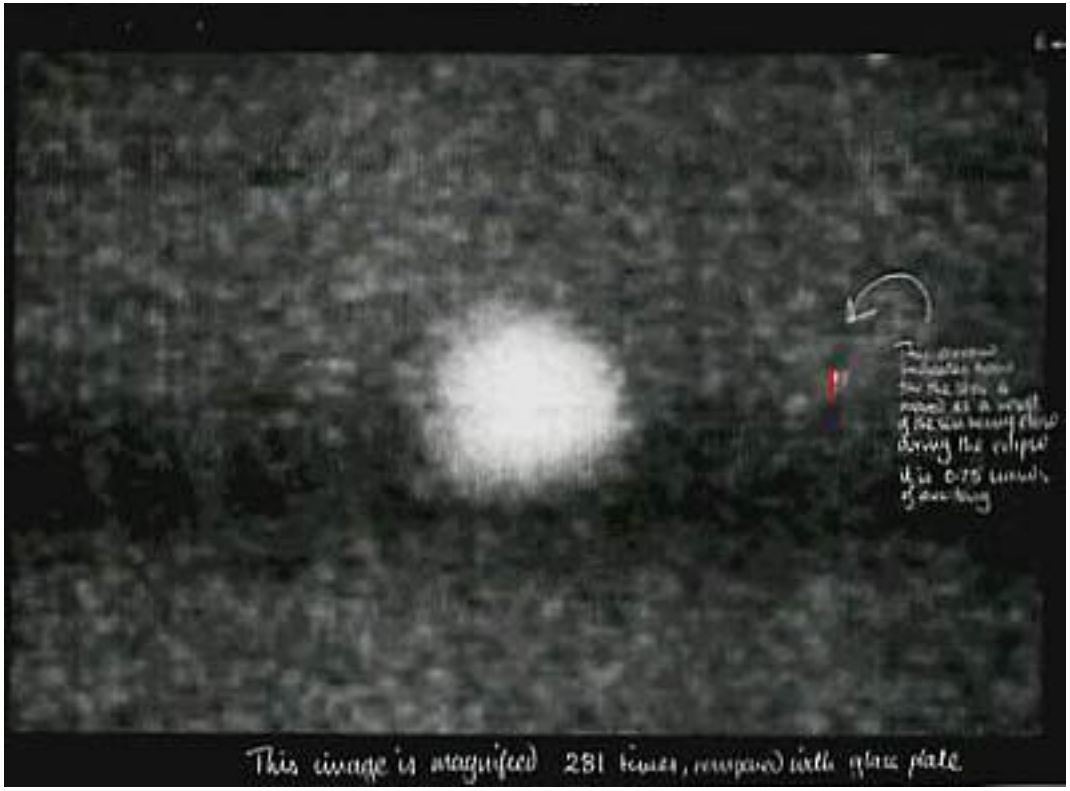

star
sun
Earth


apparent position of star
star
sun
Earth

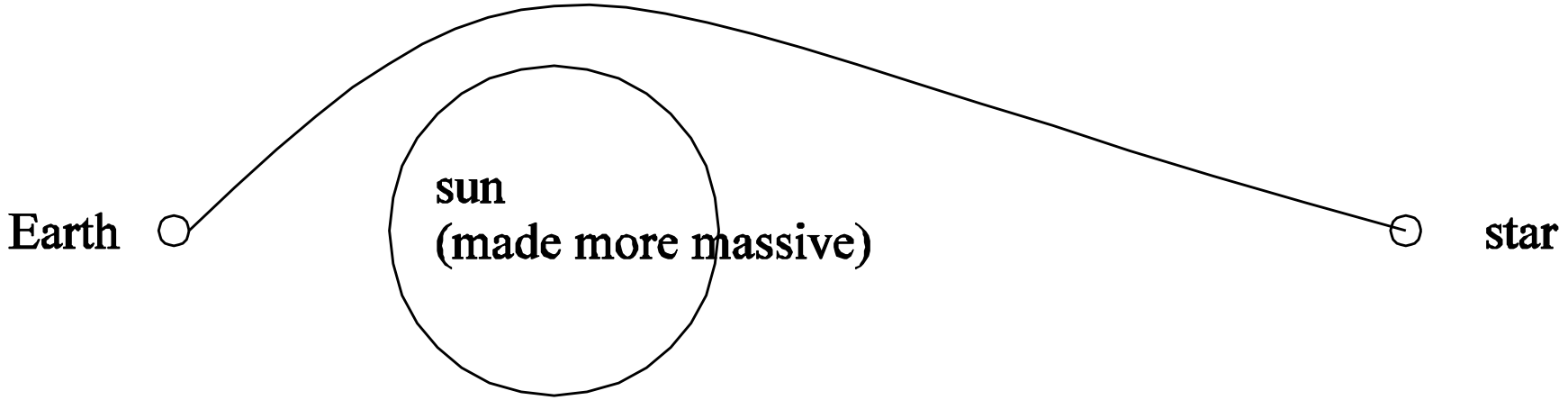
Observations by Eddington and others in 1919:

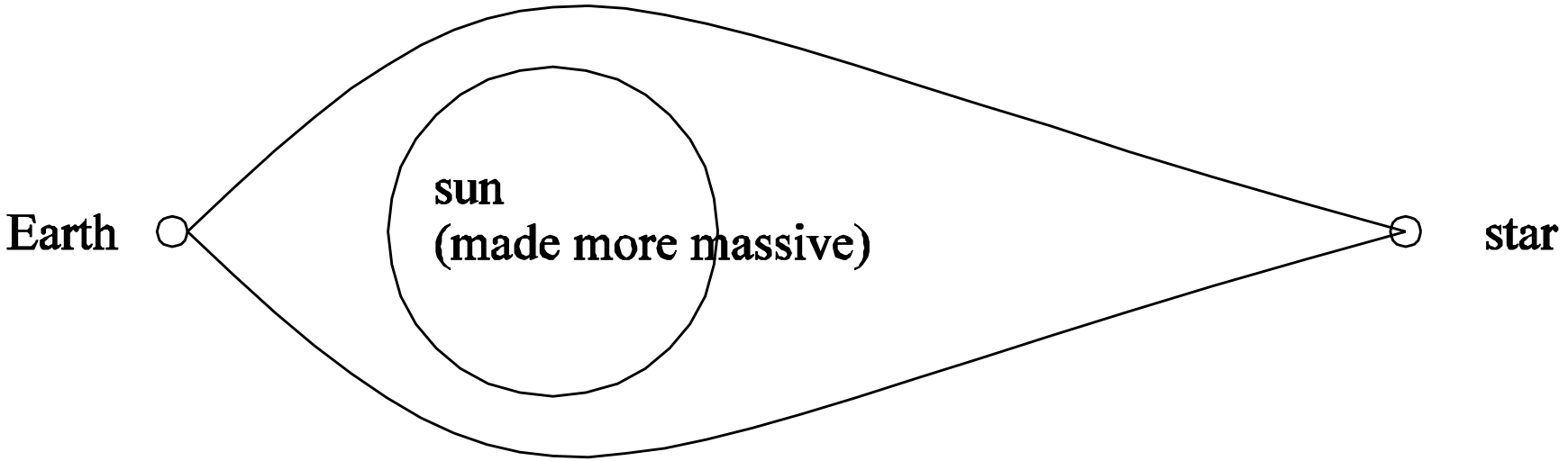


Green lines mark deflected stars



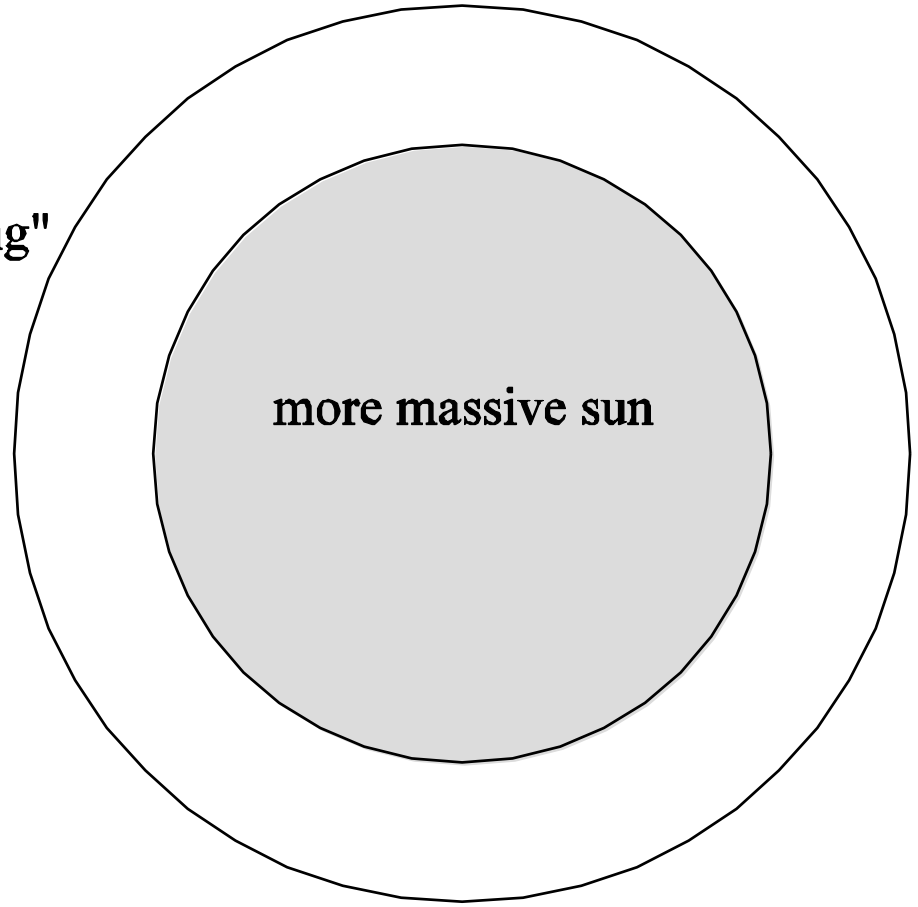
Enlargement of one of the stars –
shifted by the amount shown in the red line


Earth
sun
(made more massive)
star

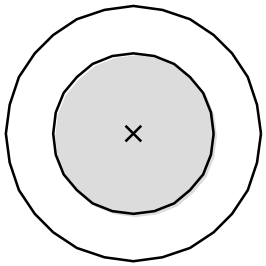

Earth
sun
(made more massive)
star

view from Earth:

star perceived as an "Einstein ring"

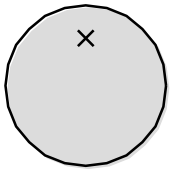


star directly behind sun
("midline", "bullseye")

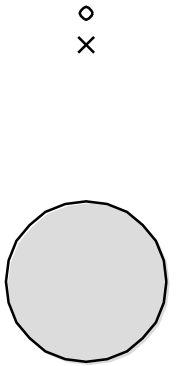


star behind sun but
off midline

?

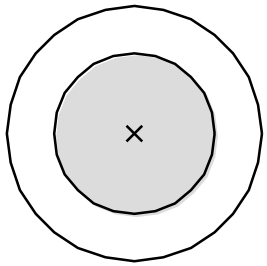


star nearly behind sun

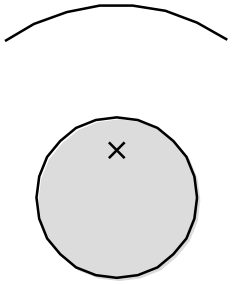


× = real position of star

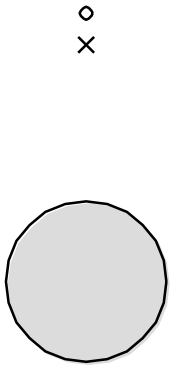
star directly behind sun
("midline", "bullseye")



star behind sun but
off midline
-- my guess

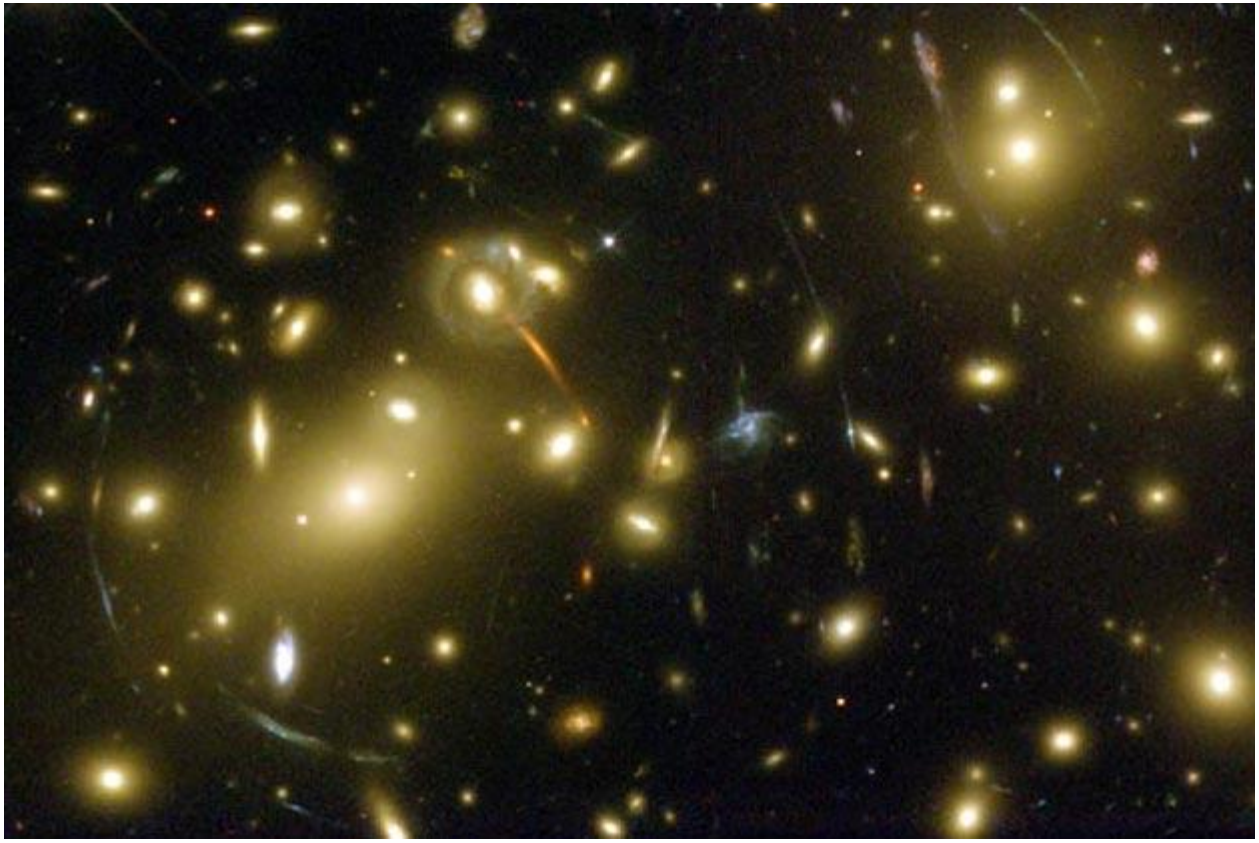


star nearly behind sun

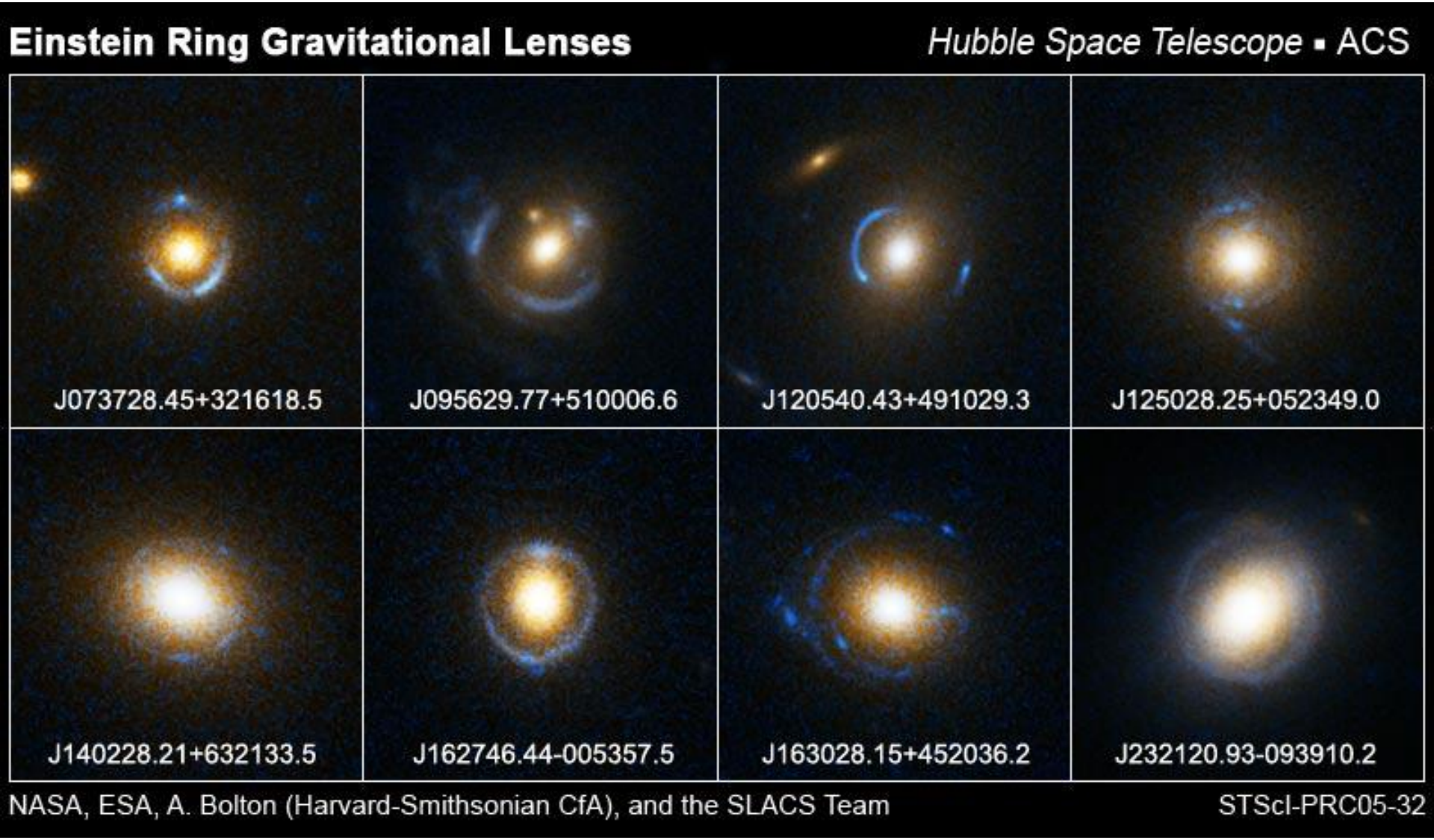


× = real position of star

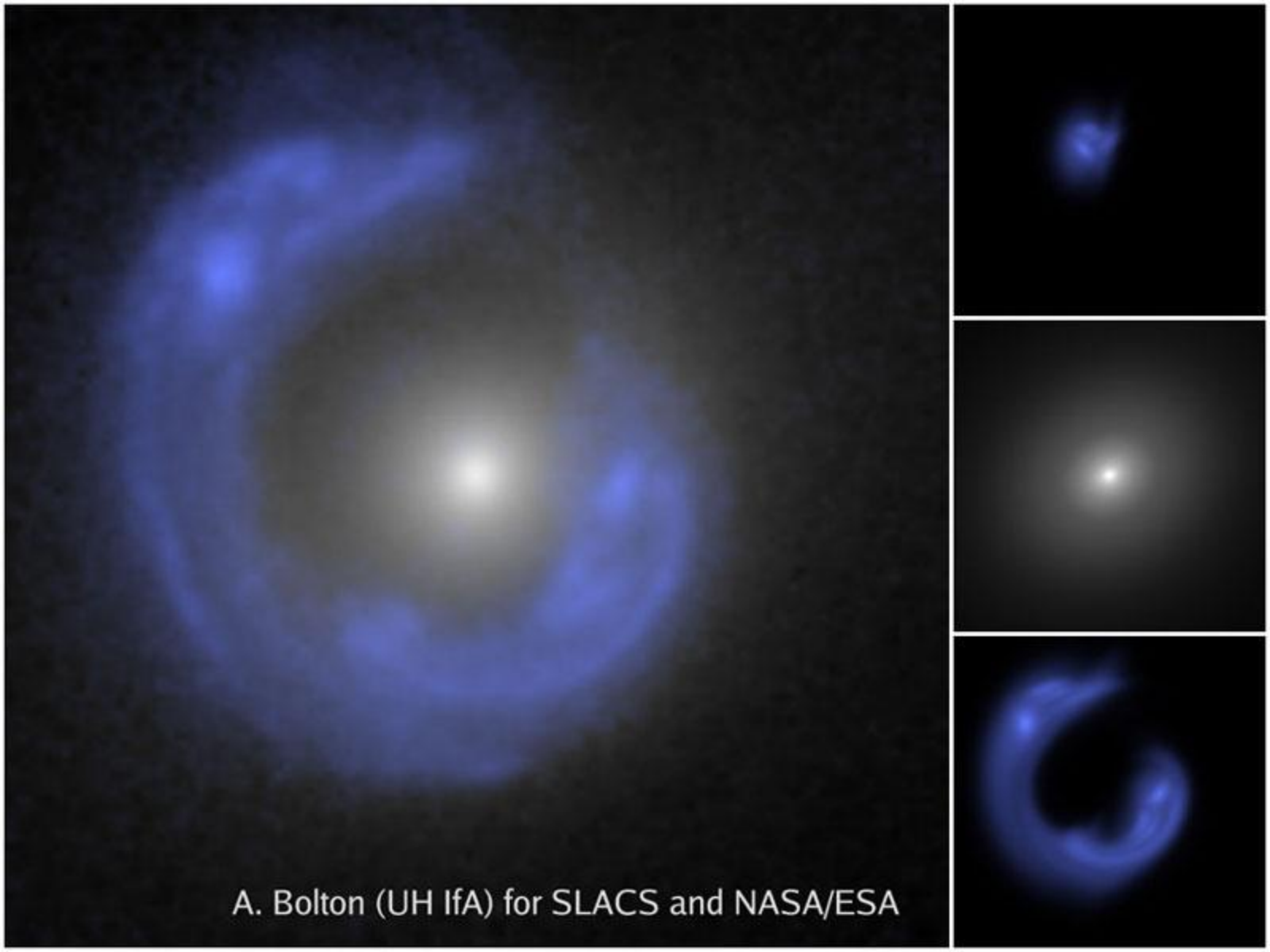
Abell 2218



CL0024+1654



(November 2005)

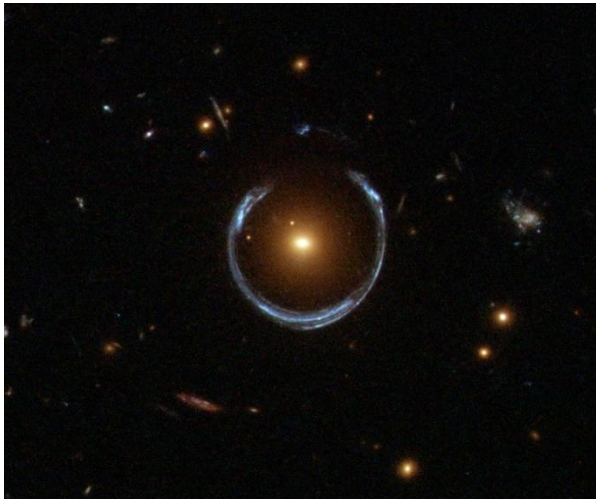


SDSSJ1430 (July 2008)

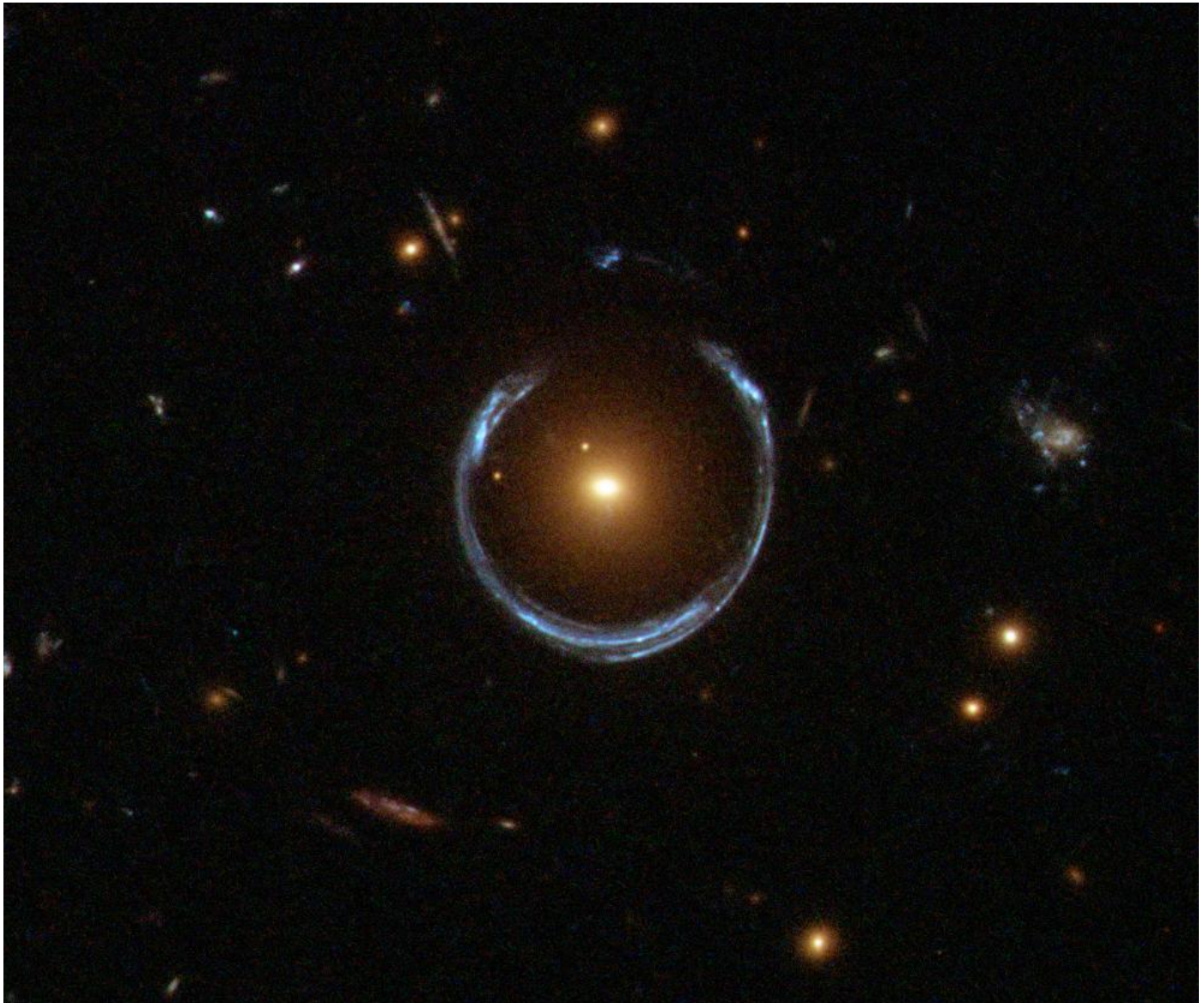
LRG 3-757

Discovered in 2007 through the Sloan Digital Sky Survey.

This Hubble image released 19 December 2011.

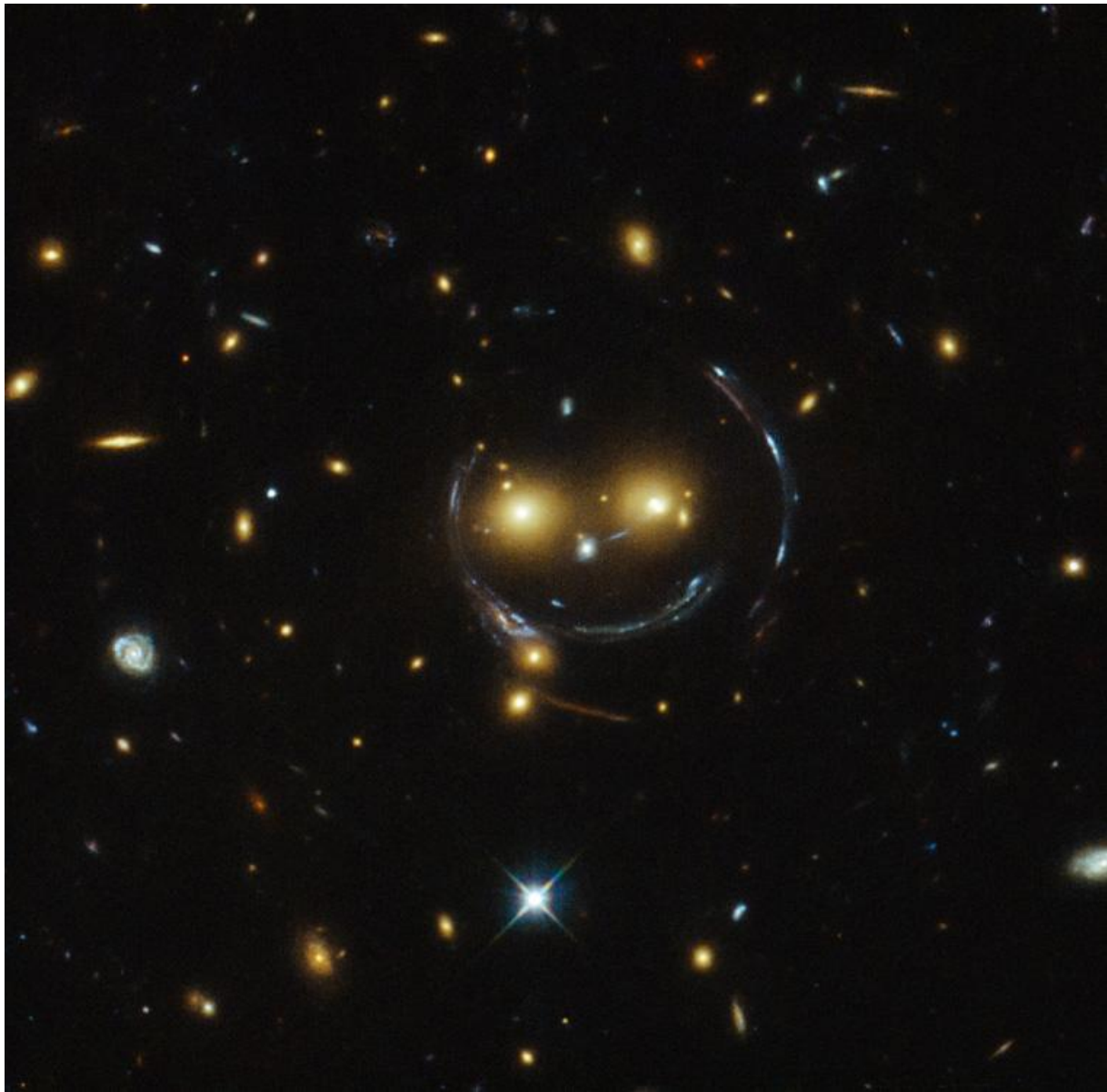


“The Cosmic Horseshoe”



Galaxy cluster
SDSS J1038+4849

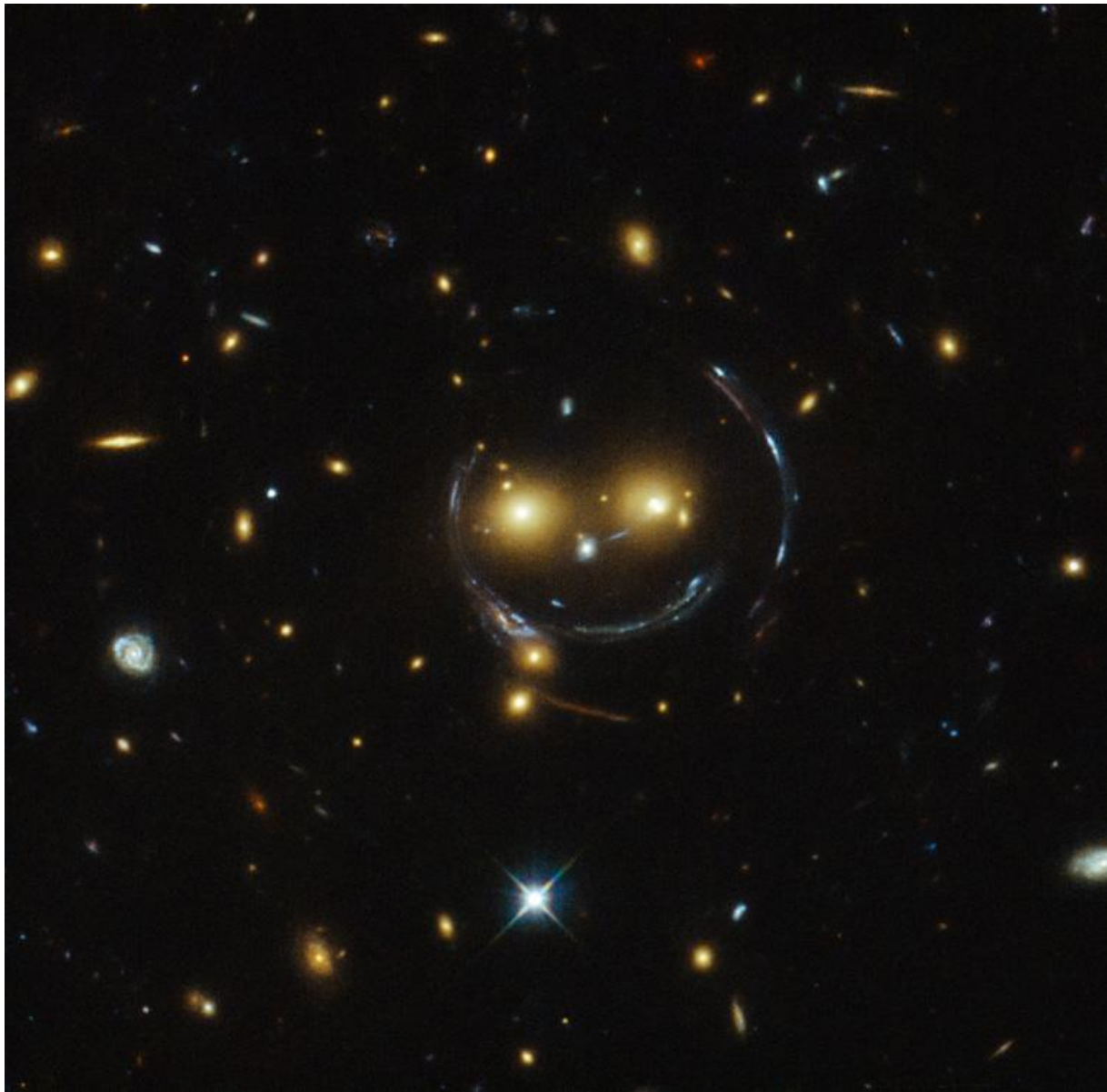
Hubble photo
released
9 February 2015

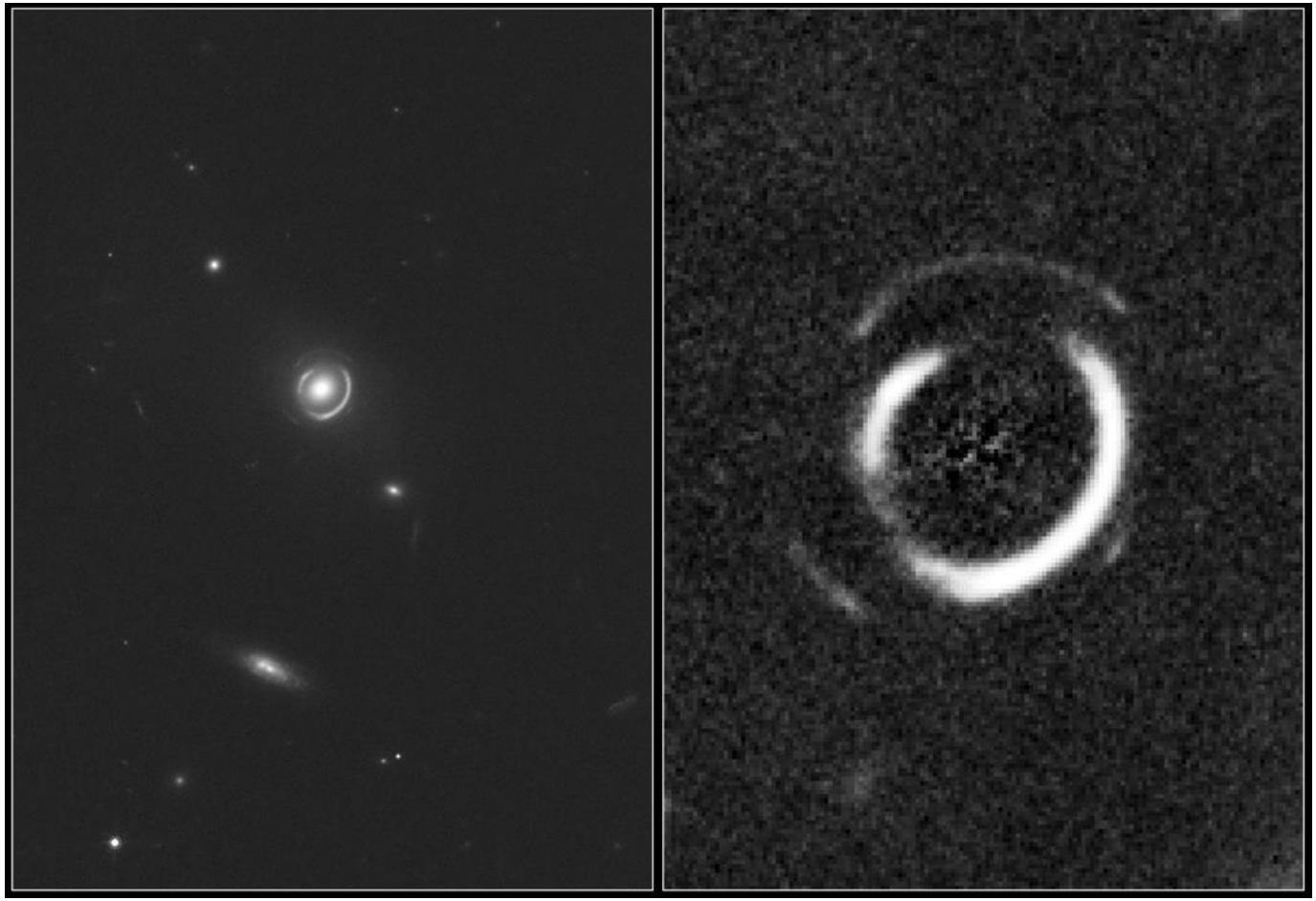


Galaxy cluster
SDSS J1038+4849

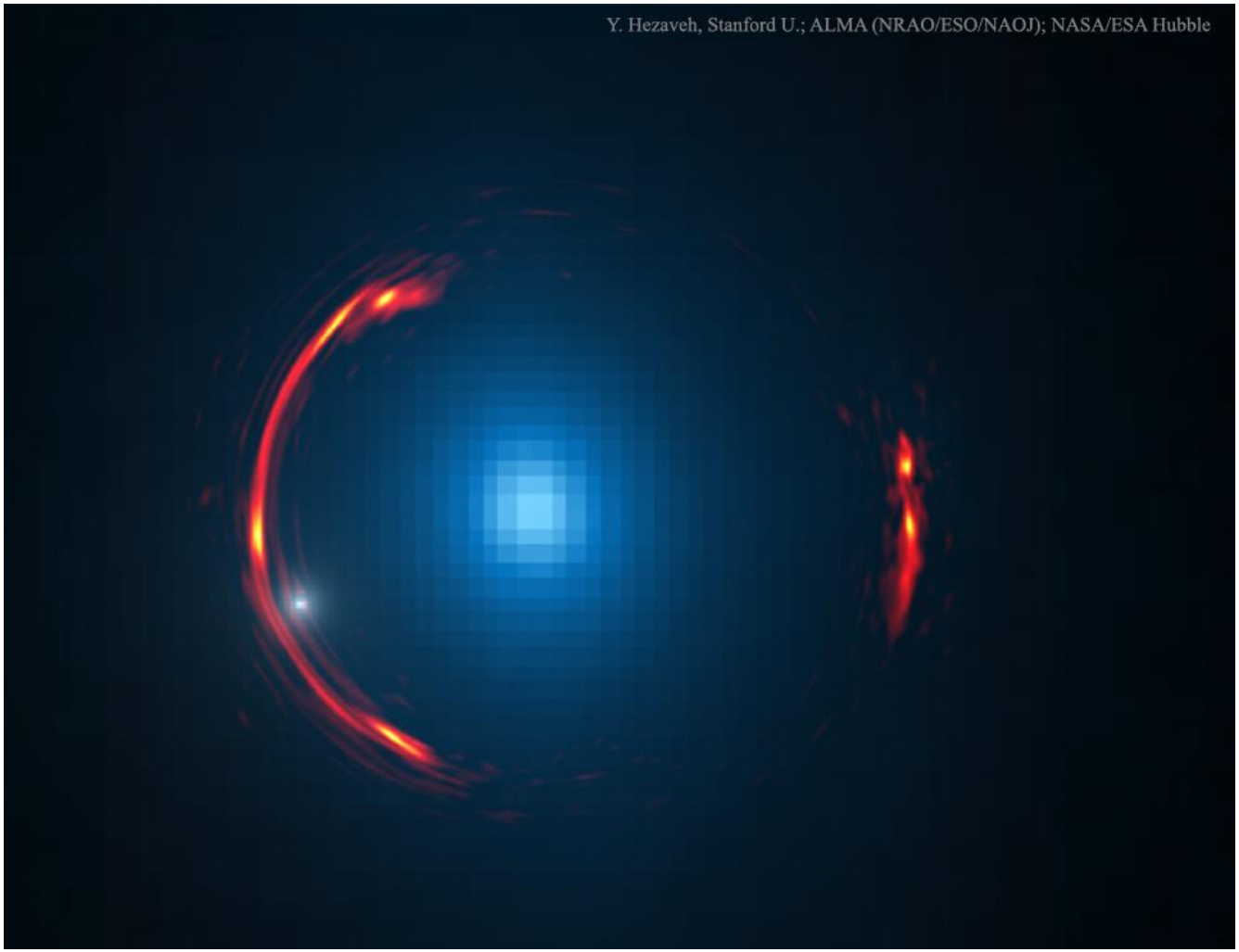
Hubble photo
released
9 February 2015

“The Cosmic
Happy Face”





Einstein double ring (January 2008)



SDP.81 (14 April 2016)

B1938+666